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In This Issue—Hundreds of Foscinating Articles Tell the Latest News of Laboratory Discoveries, Scientific T umphs and Amazing New Inventions



# The Voice with a Smile

"We hold says a well known writer that the to using ladies of the American long distance tele phone wires make up what is probably the most efficient public service crew in the world. They have profound patience and that capacity for taking pains that some one once said is all that genus amounts to

"We once called a fellow at a hotel in Philadelphia but he had just departed on an automobile trip in a westerly direction. A few days later the long distance operator caught up with him in a little town in Missouri and he was the most surprised man in all but one of the States of the Union. The exception was New York. We were the most surprised there. To this day we have no idea how the operator did it."

DAVION RUNTON in the New York Mirror

#### BELL TELEPHONE SYSTEM



 The Bell System cord ally invites you to wist its exhibits at the New York It orld's Fair and the Golden Gate International Exposition San Francisco

# SMOOTH



#### MOBIL HANDY OIL It a penetrating, non gum

ming keep it on hand for lubricating home appliances sewing and washing machinea bicycles, toya Fine for automobile generatoraand tools Convenient wall clip free with every can



#### ADD THIS TO YOUR GASOLINE!



Mobil Upperlube reaches the engine as a vapor Special supregnating ingredient is adsorbed by metal surfaces, protects rings and valves from rust and wear. MOBIL UPPERLUSE

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Shelf Contains Its Own Brackets Copper Bracket Holds Ivy Pot Toast Rack Made of Walnut Disks Game Tests Steadiness of Hand Silhouette Fireside Comfort

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#### HOME SCIENCE

Film Viewer Identifies Stars Neon Glow Lamp Testa Circuits Ody Rags Are Really Dangerous How to Prepare Bacteria Slides Bacteria under the Microacope

#### MODELS

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#### NEW SHOP INTAS

Draw In Chuck and Spring Colleta Miter Jig for a Circular Saw Wrench Holds Rods for Threading Rack Protects Bits from Damage Two Tapers Turned on One Piece Rubber Hose Holds Shop Towel Small Grinders from Old Wheels Arbor Holds Faceplate or Chuck Compact Way to Coil Solder Brush Presses Tube Against Wheel Old Lamp Used as Lathe Light Marking Very Thin Metal Shims Shop Sayings of Old Bill

#### DUIDOORS

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A LATY MOTOR AMAZING NEW LIFE

# Wits sou do tad tro ne less d Viss x— cwAu o Lie Piss would t re orted

low does this new kind of spark plug make cars run so much better?

TO WONDER car owners are astonished when slug gish pepless motors suddenly take on new life's Thousands are finding new Auto Lite Spark Plugs end tarting troubles give flashing pickup and power and estore gasoline economy

For the new Auto Lite Spark Plug was expressly de igned to improve car performance by stepping up the ficiency of the entire ignition system. It employs a ien type kommin electrode with a new geometric gap lesign that produces a more effective spark with less effort It is protected against leakage and cracking by the wonderfel new Ziramic insulator with its triple seal

See why owners of all makes of cars are so enthusiastic about Auto Lite performance Try a set of new Auto Lites in your car today



ONE OUT OF EVERY FOUR NEW CARS 5 now fac ory equ pped w h Auto L te Spa k Plug: They ha e been adop ed by lead ne carn ann fac u ers af er tl e most ex haustire and co.

ELECTRIC AUTO LITE COMPANY

TALL SPARK PLUGS ALEKE? toad No MAN You dece them n eyo the ged to Auto Lie Sa egas on Unght smarty Dut n your mag c Spa k Plugs I sa d



dayslater The motor neve hal up ne er ran so sweetly liewo as each customer with those new Au o Lie

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TO-LITE SPARK PLUCS



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Giving Liquid Medicine to a Dog Rubber Knee Bands Repel Briers

#### RADIO

Weighted Knob Simplifies Tuning Switch Controls Five Coil Set Amateur s Television Camera Fish Pole Used as Car Antenna. Spraf Brush Cleans Radio Jacks Static Muffler for Auto Radio Get Started in Radio for \$8 95 Pocket Receiver for Sports Fans

#### SHOP DATA FILE

Planing End Grain of Wood An Ink for Marking Metals Lubricants for Drilling Coloring Metal Brown or Green Flexible Electric Cords to Use Exposures to Stop Action Retouching Prints Part I

#### THE HANDY MAN

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#### WOODWOOKING

How to Lay Out Your Workshop Baseboard Bends to Fit Wall Warm Iron Smooths Sanding Disk Using Blowtorch Near Woodwork Cut Off Gauge for Circular Saw Planing Vise Adjusts to Any Wood Hanging Wall Rack for Ornaments Boys Nautical Toy Chest Gun Cabmet of Knotty Pine Gauge Samplifies Panel Marking Drafting Table for Use at Home Stripes of Paint Anchor Nuts House Jack Acts as Veneer Press



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Will you master fate or will fate master you? That's a question deserving right now! Actually it is largely up to you You can do your honest answer with Life almost what you will LaSalle will help you establish yourself for real success by providing you with the comprehensive specialized training now! Check the coupon for which it is so famous. Choose your field below for the free booklet you want us to send you. It can be your first step toward assured success.

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- (I) the man with legal training is a leader-not a follower
- (2) legal training keens your mind—clears away the problems that stump the ordinary fellow and makes you master instead of man (3) knowledge of law simplifies the complications
- of executive work. (4) Many top executive places are filled by men who have stud ed law

No matter whether you are in a b g corporation or a small bus ness—n a great city or a little town—a practical knowledge of law cannot falt to be of real and vital help to you in making a more successful career. In every state in the union you il find law trained men who came up through LaSalle. What others have

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The demand for skilled accountants—men who really know their business—is increasing rapidly. New state and federal legislation requires much more, and more and federal legislation requires much more and more efficient accounting from bia ness—big and small. Or portations are in containing red of the professional containing the professional containing the professional containing the professional Management Finance. Men who prove their qual Cationa in this important branch of bosiness are rap dip promoted to respons the executive positions—distent an opportunity to earn real salances. The range is from \$50000001 a perimeter and opportunity to the professional containing the professio to higher income figures
Under the LaSaile Problem Method you can at home

or the Lastie Problem Method you can at home acquire a thoro understanding of Higher Accountancy master its fundamental principles become expert in the practical application of these principles—this without losing an hour of work or a dollar of pay

Your training wilt be under the direct supervision of a staff of legal organization and management special-ists business efficiency engineers and Certified Public Accountants

Preliminary knowledge of bookkeeping is unnecessary We train you from the ground up or from where you now are, according to your individual needs

#### Mr. Salesman: What's Wrong?

Why aren t you making more sales-more money 7 Is it why aren't you making mote sales—more money' is it you—or your proposis of. Check up first on yourself Other men—no better than you—have found the ream ags jump and stay up when they trained with LaSalle Literally thousands of men—many of them years at the game—have increased their soles volume and earn ags through home study with LaSalle guid ance Sound—practical—usble—mght from field extended the control of the control o perience Train for top notch production with LaSalle,

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Modern Selesmonship
Business Management

Commercial Law
Expert Bookkeeping
G P A Cooching
Industrial Menegement
Modern Foremansh p

Business English Business Co respo Effective Speaking

Age



Name Position

Address

# Our Readers Say CONT NUED

holder that will shout out toud when I pick it up whether it is empty or loaded and un exposed or loaded and exposed What to do —T U Columbus Ohio

#### Winging Pop Battles at the Ump Teaches Us Something

On it ening to page 87 of the August issue I was amused by the picture of a solder from some European army testing an antitank bomb consisting of a pop bottle filted with an inflammable liquid Maybe it isn't very points to taugh at

HOPE THIS LOOKS GOOD



poilie to tauge at others but I got a good laugh at the pose the solder to striking as he threws (\*) the bomb Lett hand on hip he has just let fly with the bomb by a sideward flick—just that—of his right arm Any American boy be tween sux and saily who threw anything with that technique

would be laughed off the sand lot and any baseball fan between Brooklyn and Podunk Center who couldnt wing a pop bottle with more finesse at an umpire wouldnt sveen be allowed in the bleachers—E S B St Louis Mo

#### Insamnia Is No Prablem —in the Classroom!



There e nothing new under the sun. In your August sause you tell about a college course given at Columbia University which makes students sleep soundly Thats old suit. We have professor at my college who have your took the sun of the college of the sun of the sun

#### First Bullet, O K ,

Second Bullet, Ixnay!

Jist received July Issue of PSM today and am enjoying it very much i always read it from cover to cover Particularly Interesting is the Gus Willom Model Garage story Our Readers Say and With the Inventors One thing amuses me this month in the lat text it is the military pelmet designed by the It is the military pelmet designed by the University of the Company of t

myself wondering just what would happen if a second buttet came along before the crown was putled back to the brim of the bat by the coit springs—M L Z Taneytown Md

#### Don't Smosh Any Umbrellas Figuring This One Out

The trouble with N S slittle algebra probtem proving by algebraically correct steps that I is squat to 2 lies in the fact that the

factor (1-x) on each side of his equation x (1-x)=(1-x) (1-x) is equal to zero tha because x equals 1 as given and 1-1 equals zero Now anything multiplied by zero aquats zero so the other factors need not not as it turned out and the equation boiled down to the obvious error It seems to be seror if the seems to be served.



customary to answer one probem with enother so I retainate with one involving a bit
of trigonometry. A nine ribbed umbrella is
of trigonometry and the state of the ribber and trigonometry
are opened so that each rib makes an angle
of 15-13 with the center ritle. Find not to It and
angle any Illo makes with one most to It and
the ribber and the ribber and to It and
umbrella—P M D Cotimbus Ohio a new
umbrella—P M D Cotimbus Ohio

#### He'd Like To Read a Stary on

Nonfraudulent Spiritualists

Some time ago you published an article in your magazine exposing the methods em

ployed by fraudulent sprintualists I should take to see another ar tiele covering phenom ena which have not been proved fraudu lent and possible scientists and possible scientists are to the proved fraudulent and possible scientists are would an article on present-day findings in the realm of mental telepathy Incidentally your new arrangement makes



opinion -- W S P Corry Pa

#### That Article on Future Cars Is Still Hitting on All Cylinders

i to bounes Mr moaning paper recently summarized a er I found talk made by David Beecroft a past press (Continued on page 11)

# Step Up Where You Belong

What Is Your Present Level of Preparation?

The FIRST proof of personal ability is your capacity to see the need for training and to GET IT. The min or noman who doesn't reals a that education is or noman who doesn't reals a that education is \( \text{ITAL to success—or who says he or she doesn't have tree hish it he money or that study is too hard—is mply lacks one of title \( \text{ fidure instal of the ABILLT\) to make good \( A \cdot \text{ as } \) \( \text{ fidure instal of the ABILLT\) to thousands have \( 1 \cdot \text{ Visit } \) \( \text{ fidure instal of the W\)\( \text{TS} \) an essential education \( CA\) \( \text{ III } \)\( \text{ fidure in loop} \)

#### You Are Only HALF a Man Until Training Rounds Out Your Ability and Experience

To make your natural ABILITY pay you profit and to get jobs that gave you the AELYEL RESIDENCE AND THE PROPERTY OF THE PROPERT

#### Write for Facts No Obligation Make up your

Make up your mind to enjoy the GOOD things in lie lave FAITH in yourself in your country and in your future Expect Success and get ready for it Write for FREE But let in TOD 12 (Sec.



Gets Only the "leavings"

With only grade school education you are virtu ally CONDEMNED to the low pay men al jobs that others DON T WANT because THEY are trained for better things. Home study can it y OU too for moredesirable betterpa d

#### Pays Up to \$16 a Week EXTRA Income

Clerk

U S. Bureau of Education figures U.S. Bureau of Education figures prove that the average high school graduate earns 51b a week more thin grade school graduates. A outcan complete our samplifed High School Course in SPARE time at hoose as FAST as time and ability term t. MANY FIV. 15111 V.2 YEARS. Equivalent to 15H1V2 YEARS, Equivalent to resident school work—prepares for college pre-professional ex-minations businests, industry Standard texts. Diploma, Or if you've had some high school FIVISH now, Cred t for subjects already completed 5 nelesubjects if des red Low to tron easy terms. American School Cheago, est. 189—endorsed by educators

Secretary Business Executive Nurse

### Pays Up to \$25 a Week EXTRA!

Government figures show that graduates of specialized training of college grade average \$75 a week more than tru n no of college grade average \$75 a neck more than high school praducts. \$11 more than grade school grad wates, But whether you fauled to right school grad wates. But whether you fauled to right school grade to right school subject as the school subject are included in vexational course is lated below. More than 1-3 noted educations, engineer and executive a higher than 1-3 noted educations, engineer and executive a higher standard authorities—exchanate vice-department and executive about the school subject as the school subject is a foundation of the school subject in the school subject is a foundation of the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subject in the school subject is school subject in the school subje

student. Why continue in an underpa d overworked job—subject to penod clayoff? Stept Dubrety wholey intowell pa d pleasant work, where you command the admiration and respect of others for full details, mail roupon RIGHT NOW! 

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Retail Merchandising

Spare Time Training Can Help You in Your Work—and Socially

# Our Readers Say ICONT NUED

dent of the Society of Automotive Englacers at a meeting of that organization at White Sulphur Springs W Va I note that he points out that the future will bring cars of entirely different basic design from those of

today as did your article in the June issue New Patents Forecast the 1942 Car They will have engines in the rear said Beccroft as did your article And he declared that they will have a superstructure integral with the chassis as did your article Both the speaker and your article pointed to evolu tionary trends in car design and predicted what the future car would be like if the trends continued I would like very much to have heard Beecroft's talk as I am in tensely interested in the subject At the same time I doubt if I would have enjoyed it any more than I did your article In telling what ears of the future will be like the author of your article did a splended job basing his predictions on sound reasoning Good stuff Let s have more like it -F L New York City

#### The Ice Age Was a Myth, Declares This Reader

REPLYNO to B L.C. Trumansburg A Y in regard to the lea Age will say that the Ice Age is only a myth. If not why do we find the skeletons of animals also the bodies of perfectly preserved mastodons and other creatures that once



lived in a hot country? At one time there were continents in both the Pacific and Atlantic oceans which were sunk by an earth quake so terrific that it caused a tidal wave that swept over what is now known as Man churia carrying every thing north in its path Buried cities are found

in that country to this day When the water receded it brought down the tce over both hemispheres destroy ing nearly everything preserving some things All this was many centuries ago some estimate it as far back as 70 000 years -W L G Oakland Callf

#### There's No Use Trying It, Even in Modern Warfare

Your recent article on coast-defense puns reminds me of a rather priceless comment once made by Admiral William D Leahy then Chief of Naval Operations U S & before a Congressional committee Here is the of cial record of the testimony Senator Cerry It is an old established naval policy as it not that you cannot attack successfully land fortiscations with even capital ships if these land fortifications are modern and in proper condition? Admiral Leahy I think it would require a very dire necessity to in duce any naval commander to take his fleet under the fire of modern shore batteries Senator Gerry Because the advantage is en tirely with the shore battery is it not? Admiral Leahy The shore battery has one very decided advantage. It does not sink when it gets hit with a shell. I think that rates the Admiral as something of a wit-B T Newark N J

#### Father Burned His Fingers When He Bought That One!

THE curious self-destructive pepper shak er that A.D N of Vancouver B C writes about reminds me of what happened once when I was a small boy before electric lights In those days

a good lamp chimney was an important mat ter Father bought one that was supposed to be shock and heat proof To show it could take it the deal er threw it over his head and it felt to the floor without breaking We used it for several weeks when one night as usual Father blew out the bight and went



out the light and went to bed After the chimney had tims to get thoroughly cooled we all heard a loud ex-plosion similar to a pistol shot. We found the lamp chimney blown into hundreds of tiny pieces and scattered all over the room Maybe soms reliable glass factory can explain it At the time we found no one who could -A. H B Los Angeles Calif

#### And the People of Florida Might Like Ta Keep Their Gulf Stream

HICs idea about pumping Gulf Stream water to the antarctic is a pretty impractical one I think In the

first place it would be virtually impossible to lay a pipe tine that far not to mention the cost of keeping the pipe in condition in the second place the cost of pumping would be terrific And in the third place why not pump the Gulf Stream water to New England where we wouldn't have to travel several

WE COULD FORGET

THE IDEA

thousand miles to take advantage of it If hes so stuck on pumping it? J G G, Gamesville Fla

# The show that NEVER came in !



Somewhere in the Ocean of Opportunity, there's a Sargasso sea of lost ships They were launched with laughter and

hope, and the expectation of rich cargoes. But they never came in. Sometime during their voyage, the winds of Ambition died down . . . and they drifted, canvas in tatters and hulls rotting

Where's your ship? 2

One bundred thousand ambitious, determined men are enrolled today with the International Correspondence Schools, They've plotted their own courses. Their

hands are firm at the helm of their own destimes They know that hope isn't enough ... And they're getting the sound, practical training that will help them to succeed!

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# With the Inventors

HAT are the greatest American in Ventions? A committee of seventy five scientists and industrial leaders recent ly examined eighty outstanding American inventions and



selected nineteen for the roll of honor Try making your own list be fore you read the roster that follows Eli Whitney a cot ton gin Robert Fulton a steamboat Cyrus Hall McCormick s reap er Samuel F B Morse's telegraph Charles Goodyear a rubber vulcanta

tion process Elias Howe a sewing ma chine Christopher L Sholes's typewriter

George Westinghouse a air brake Alexander Graham Bell's telephone Thomas A Edi son a phonograph incandescent hamp and motion picture projector Nikola Tesia s in duction motor Charles M Hail a atuminum Ottmar Mergenthaler a linotype machine Wilbur and Orville Wright a air Lee De Forest a three electrode vacuum tube Leo Backelanda synthetic plastics and William M Burton a oil crack



note and let ua know which trio you would choose FOR PROTECTION AGAINST the ray ages of dust storms hurricanes tornadoes bombs dropped from the skies Andre D Amico of Rochester N Y

suggests homes

mg process And

suppose you had to select the three

greatest inventions

from this list of

nineteen-send a

that can be made to disappear into the ground Built over a pit dug in the earth the two story structures are lowered into the hole hy means of a hydraulically operated plunger so that their reenforced metal roofs are flush with the ground level Movable bolts attached to the houses rest on a ground level ledge to sup

port the structures when in their nor mal raised posi tions HARDLY A SINGLE WEFK passes without the issuance of at least one patent for some new kind of a coat or garment hanger

IF A DRIVING rainstorm comes

up during the night you'll find your windows will close automatically if they are equipped with a device worked out by Peter Pusak of

Eddystone Pa Wires attached to the win dow sash are fastened to a spring operated roller mounted on the sill. When the window is open a strip of special paper holds the roller against the action of its spring but when rain or fire causes the paper strip to break the roller is free to draw the open window down to a closed position ARE BELIEVED to have been the first patents ever issued in the world were granted by the ancient Greeks to their chefs to en courage the invention of new palate tickling food concections Wonder who got the first patent on hash WITHOUT CHANGING OF removing any telephone parts an attach ment developed by George I Dormont of



Los Angeles Calif provides luminous numerals to make it easy to dial numbers in the dark or in phones locate! in hadly highted corners or booths. Made of metal plastic or heavy paper in a dark color the attachment consists of a flat ring that fits in (Continued on page 18)

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(Continued from page 16)

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VAILS or other type of permanent attachment is needed to hold in place novel brack

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ets designed by James H York of Cinchmatl Ohio to support both a window shade and curtains Made of metal the brackets are provided with separate notched (Continued on page 20)

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# Hints for Home Owners



Windows slide an steel guides as shown below In the photograph of the left ane of the frames is being lifted out for washing



SLIDING WINDOWS that resemble easement types when closed and require no sash weights or hinges are now on the market Each sash slides horizontally on poished steel glides guided by a head and sill track Both sashes he in the same plane when

closed but one pulls inward and slides past the other to afford a single large opening Sliding both asshes forms an opening at either side of the units which may easily be removed for cleaning or installation of double glazing for winter use



#### Metal Edging Makes Neot Lawns

To HELF give a neat appearance to driveways walks flower borders and other features of a lawn, easily installed metal edging is now available. Made either of zine alloy or galvantized steel the material comes in interlocking strips that are driven into the ground and supported by metal readroring stakes.

#### Holder Locks Door at Various Angles

Doors may be held firmly in place at various angles by a new holder designed to be mounted on the door at the hinge. Made of steel plated with brans the device will hold a door steady at five different angles under ordinary conditions, even when windows are open and a breeze is blowner.



Reenforcing stakes support the metal edging along lown borders



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#### Hidden Screen Unrolls When Window Is Open



type window insented by Jack Stangler, of New York City, and a screen automatically appears in the openme Screening is mounted on cealed rollers and is pulled into place by the action of raising the bottom sash or lowering the top By this means, screen ing does not cut down light entering the window when it ia closed. The sash can be made of Screens come into place metal wood, or plas

THFOW UP the sash of a novel reversible-

os windows are opened

#### Paint Brushes Cleaned by Dipping in Solvent

PAINT BRUSHES are easily cleaned after use, without soaking in water or oils, by dipping them in a new solvent that quickly dissolves the paint on the bristles, and emul sifies it so that the pigments and oils can be runsed away instantly under a water tap The solvent is said to have no harmful effect on bristles

#### Smell Killer for Paint

NO ENPLEASANT and approying odor of paint will cling to rooms recently painted if a small amount of a new chemical compound as added to the paint before use



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#### RAYMOND J BROWN, Editor

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# **Enlarging the Panama**



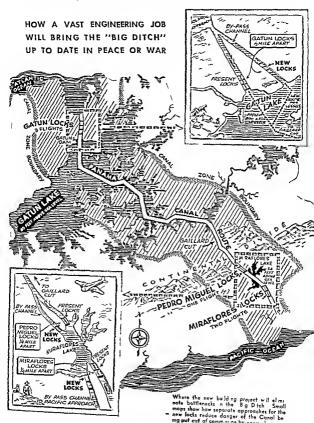
TEAM SHOVELS WII 8003 50 carming spain at the Panema canal. Only a little more than a quarter century of the party of the

The giant engineering scheme calls for conversion of the present two-lane canal across the Isthmus into a three lane canal. To do this three sets of oversize single chamber locks will be built parallel to the present twin chamber locks but at some dispresent twin chamber locks but at some disdig a whole new canal since the Big Dirch itself will easily carry the traffic.

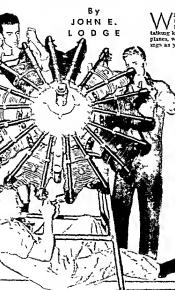
Why the new locks? First and foremost

they will assure the U.S. Fleet of unobatructed passage between the occasis in cases of emergency. Canal authorities long have been littery over the possibility of sabotage or direct attack on the present locks A vessel might be shown up or time bombs might be though up or time bombs might be competed by raiding to the locks might be showned by raiding from the air happened to destroy though the by side lock chambers at once the entire Canal would be put out of commission. Therefore for many months a force of sev

# Canal for bigger battleships



# **FLYERS BY THE TEN**



HEN you walk across a campus these days you are quite as likely to hear undergraduates taiking knowingly about low wing monoplanes, wing-overs, and cross wind landings as you are to hear them discussing

mouse-trap plays, heavy dates, or passing marks. The Civil Aeronautics Authority's bold and successful venture of training youthful flyers by the thousands has made John College and Jane Coed go air-Don't think that these collegiate aviation talkers are mere "hangar pilots" Most of them are flyers, or are well on the way to becoming flyers During the college year of 1939-40 about 0,000 of them, enrolled in 437 colleges located in every state and in the District of Columbia, Alaska, Hawan, and Puerto Rico, earned their private pilot licenses. In addition, well over 700 noncollegians, winners of competitive flight «cholarships offered the students in seventy ground courses aponsored by civic organizations in every state and in the District of Columbia and Alaska are receiving exactly the same training

College students learning about airplane engines as part of the ground school training in the Civil Aeronautics Authority program

Training Program in Colleges To Provide Huge Army of Pilots for Uncle Sam

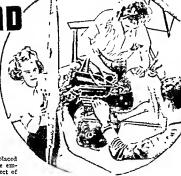


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When this nation-wide training effort was started last fall, its primary objective was to accelerate the already swift progress of civil aviation in the United States by teaching large numbers of young men and women to bandle their own airplanes safely in either own airplanes safely in either and objective was the safely in the safely of the safely safely are the safely safely safely as the safely safely

The swift and menacing march of world events in the past few months has brought about a reversal in the degree of importance placed on these objectives Now most of the emphasis is on the national-defense aspect of the program, which has been greatly expanded. In the course of the coming year the C.A.A. courses will give ground and primary flying training of 45 000 students in three intensive courses, each of which, instead of heing spread over the school year, will be compressed into four months In addition, the 9000 1940 graduates-over ninety percent of them have indicated their desire to hecome military flyers-will be given forty five hour advanced courses in faster planes than those which are used for

the primary training
The Civil Aeronautics Authority, the
Government agency charged with the regulation of civilian evaluation has no direct
connection with the armed services. The
graduates of its flying courses are not combat flyers, and have no military obligations
which are not shared by nonfiyers of the
same age. But the training they receive
is the equivalent of the flying training given
Army and Navy flying candidates, and it
will enable many of them to qualify as com-



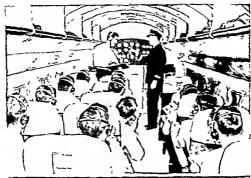
Girls are eligible too and many of them already have qualified for their private plats' licenses

hat figers after six months of advanced specialized training in service flying schools When the project of providing wholesale flight instruction first was considered late in 1938, an ahnormally high percentage of student flyer accidents was helping to make private flying, with a safety rate of only 750,000 miles for each fatality, the most hazardous form of aviation But careful intestigation indicated a method by which mass production of pilots might be achieved With a high degree of safety It was found that the students of flying schools which had thorough ground courses and sound flight courses suffered far fewer fatalities than did the graduates of schools whose instruction standards were lower

> chance to learn to fly—so enthusi-A campus flyer comes in far a landing The flight training is given by plane operators at near by airports

ates enthusiastically grabbed at the





In a flying classroom, students from the University of Mianu, Flat, listen in with earphones to the rad a beacon's gnals and watch the a strument pasel white souring 7 000 feet above the earth

aspeals that at the University of Alabama there were 1000 applicants for the thirty places in the class. A total of 230 students with high physical qualifications were accepted at the thirteen participating colleges. All of them reached the volo stage and 317 won private-plot hereises. Their average firing time to the certificated stage was thirti-eight hours and they few a total of 1200 000 miles with only a single statisty.

Convinced by this et perience that the was to increase the safeti of flight instruction was to raise the quality of the instruction the CAA standardized its ground and flying courses and required all airmen holding flight instructor ratings to familiarize themselves themselves themselves themselves themselves

An instructor explains the working of the tall surface of a plane. The thorough ground training has produced a remark able record for safety.

with the improved instruction methods and to pass an examination to prove that they had done so. More than 4000 instructors passed the test, assuring the Authority of plents of highly-qualified teachers for its training program.

Congress passed a Civilian Phlot Training Act and provided \$4 000 000 for the 1920-40 courses. Undergraduate interest was so been that colleges ranging from stately irre-



covered institutions to little city and junior colleges offered the pilot training courses

When school opened last September over 9300 undergraduates who had passed the searching physical examinations given by EAA flight surgeons were accepted as students By June they had logged 310 000 dual and solo flying hours—almost 22 000 on miles—with very few mishaps and only one fatality. That remarkable record is a miprovement of 3700 percent over the safety record for flight training for the whole country only a year ago!

whole country only a year ago.
Under the terms of the Civilian
Pilot Training Act at least five
percent of those enrolled for the
courses must be noncollege stu
dents. To provide instruction
for these the CAA enhated
the cooperation of chambers of
commerce university extension

Some schools have shops file the one below where students learn to build and serve a orcroft by actual practice. At the right a flying coed uses an instrument to gauge height of the celing

services American Legion posts aeronautical associations and civic clubs in communities of every state. The ground courses which are exactly the same as those offered in the colleges are open to anyone but to be eligible for one of the ten flight scholar ships offered with each course the student must pass the same physical examination given the col. (Continued on page 219)

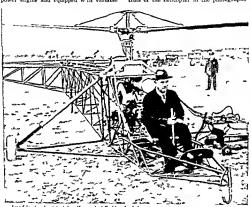




## Helicopter Flown Successfully

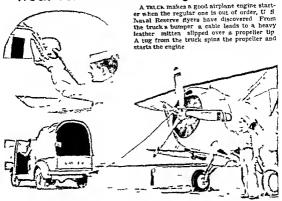
WHAT is claimed to be the first success fully controlled vertical flight in a heavier than air machine was made recently by Ivor Sikorsky prominent aeronautical engineer at Bridgeport Conn in his new helicopter Powered by a seventy horse power engine and equipped with variable

pitch rotor blades the craft moved straight up from the ground for thirty feet circled the field and then settled vertically to the ground Small rotor blades mounted on the bare fuselage of the craft act as elevators and rudder Sikorsky is shown at the con trols of the belicopter in the photographs



At top the odd much ne in the air

## Truck Serves as Plane-Engine Starter



All set to son the motor on a Naval Reserve place inset shows in them, being placed on propeller tip



Navy plots often land on the water This time it's the other way around

#### Baptism Marks Graduation of Naval Flyers

HES learned to fly for the Navy-and now three bucketfuls of water symbolizing the Navy s domain initiate this proud fledgling into the ranks of his fellow airmen at Floyd Bennett Field New York City Scarce ly less than an official decoration he will treas ure the picture of the traditional ducking that a friend is about to snap Sometimes instead of getting a shower a new pilot may receive the rare honor of being tossed off the pier The Navy birdmen say there is little to choose be tween the soakings

# Cowboys on Wheels

#### **BOW-AND-ARROW HUNTERS RIDE DESERT JALLOPIES**

DUNCING over bowlders zooming up steep embanisments punging down goals created from automobile odds and ends carry Walt and Ken Wilhelm of Vermo Calif on daring expet tions in to the Mohave Desert Aboard these remarkable vehicles called Lens and Prowler the two brothers chase jack rabbits rope coyets hunt game with bows and survo scapior remote corners of the desert search for Young trail outland and resous lost

They think nothing of starting Lena or Prowler across the desert leaping out and riding I ckety splt over cactus and across the frequent washes on sle ghs or toboggans attached behind By slipping a U bolt over a spoke of the steering wheel either car can be directed in a straight line or a wide circle. Sand backs and bowlders offer no obstacles to the buge tires. Near Yermo I once watched Provier roaring driveriess around a circle nearly to on miles wide. The car plunged down narrow guil es sithered through sand overrode needle pointed cac us spines returning in ten minutes to our side plus of the province of the province of the pointed cac the spines returning in ten minutes to our side plus of the province of

When the car approached both men fitted blunt arrows to their bows and as it passed Walt fired quickly at a large rice straw tar get slung behind the back seat. As the broad head struck the bullseye the automo ble motor stopped dead and the car coasted to a halt. We never go out unless the dis

connect awitch is in working order Walt explained Once we were thrown out while r d ng over rocks and the ANDREW car crashed into a nar row canyon The thump R. BOONE of an arrow provides force enough to slap the target against the pro-Standing on Langs Font plotfo m Wa Whalm shoots from the hip at a coyote Left with the k



Walt spings to a safer seat and the sturdy con tapton plaws strught off the edge of the hill

What happened to the car? I in

quired She's still there-a mess of junk

That was loss number one A few months later while playing around the treacherous potholes of Soda Sink

Walt felt the tires sinking Leaping to the soft earth Ken and he rolled half a city block to hard ground When they returned thirty minutes later with timhers the car had disappeared in quicksand

Both Ken and Walt will tell you they as sembled their unique desert cars for the thrill of bumping along off the beaten path That is the truth but not the whole truth Both brothers are enthusiastic archers. In the desert they are able to practice incessantly now shooting at a bounding jack rabbit again loosing arrows at an artificial deer

#### AUTOMATIC CUT OFF

In case the boys are thrown by a

bump on arrow shot ago not the target stops the vehicle. With the wheel clamped (below) t if avels in any fixed circle. The size is a cayate decay.



which Walt built not long ago Driven by a gasoline motor and ec centric gear it jumps up and down in the brush exactly like its prototype So expert has their desert prac tice made them that last summer Ken set a new world a record for distance chooting He is the first man in all h story officially to send an arrow farther than half a mile

half a mile

For nearly twenty
years the Wilhelma
have been exploring the

Mohave in various k nds of vehicles Grad ually they evolved their present cars You could buy the parts for either Lena or Prowler at a junk yard for \$200 or so But you d work six months putting them togeth er It took the brothers exactly twenty four days merely to fasten the tires to the rims They started with huge twelve ply truck tires Boots countersunk and held sirmly over blow-out holes by carriage bolts went in shead of the tubes. Using hydraulic jacks they struggled until they pushed the thick beads onto the narrow rims of twenty inch wheels So tightly are the beads wedged that flats never bother them The fire walls are very strong Walt explained "They'll carry us anywhere and by forcing the tires on narrow runs we anchored them so they can't turn and tear the valves out In each of the ma

ch need they installed two gear boxes giving them many speeds for ward and in reverse foo Carrying only eight pounds of air in the tires they can push up a steep rocky hill with the en gase turning fifty revolutions to one of the rear wheels or they can speed along the smooth high

way at a two to one ratio. The bg tires take up most of the shock in rough gong You oughta see Ken when he s in a hurry. Walt told me. He ll jump straight off an embankment going fast enough to land on his wheels.

Sometimes but not always Once Ken truck this stunt while changs a coyote and straddled a hillock breaking the motor block in bair. After walkeng eleven miles for help he decided to armor plate the motor. Now both lens and Frowler are protected by a heavy sheet of bouler plate bott edid against a cushion of wood beneath the pain of each engine.

Another time the Wilhelms were grind ing cross country in Nevada fifty miles

from the nearest crossroads when the welds holding a disk wheel to the flanges broke under the pounding vibration. Should they try to repair the damage or walk three days for help? Walt took down their 30/06 rifle and shot three holes through the disk to form an ap proximate triangle Next he shot three holes in the flanges outlining a similar triangle Finally they holted the wheel back into place and drove slowly to a d stant mine. Here using salt and fine sand as a flux, they brazed the metals tightly with the metal from used rifle shells

On several occasions the adventurous par and their desert cars have been pressed into service by the local sheriff for hunting outlaws and on other oc casions they have headed into the Mo have on errands of mercy. The most spectacular of these trips was a sixty mile journey through snow and over two mountains carrying food to a dozen starving miners. As an aid to keeping in touch with each other when roaming through desert wastes the brothers recently added the latest pieces of equipment carried by Lena and Prowler a pair of midget short wave radio sets. If either brother is in difficulties he can send out an SOS with the assurance that the other machine will soon put in an appearance taking gullies and rocks in its stride

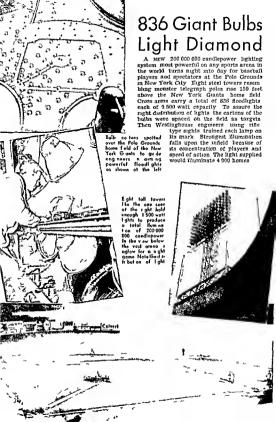
When the going gets really tough and there is obviously



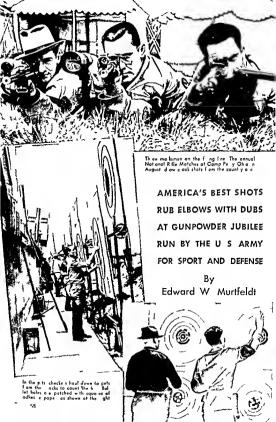
This mechanical deer bounds across the plains real st cally providing excellent baw-and arraw practice

Selecting two straws-one longer than the other they draw lots. The one winning the draw takes over the wheel and drives. Climbing a steep mountain one morning they approached a sharp switchback Out came the straws Ken won Before they got out of their fix it was sunset. Yet they set out for more sport like it next day





# Uncle Sam's **Shooting Gallery**



RAFILING in planes trains buses private cars trucks and even on foot more than 10 000 eager men women and youngsters from all corners of the nation will head toward the shores of Lake Erie in mid August for the largest sporting even in the world. The lure that draws this myriad of bankers housewises G men clerks police shopkeepers and citizens from practically every other walk of life is the annual. Vational Rife Matches spon sored jointly by the U.S. War Department and the National Rife Association

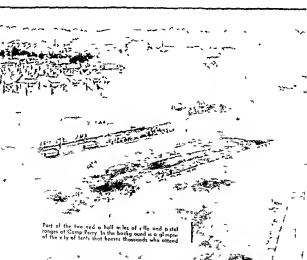
In this mammath gunpowder rodeo millons of rounds of ammunition will be fired
from pistols. 30 caliber rifes and small
bore guns Folice will school themselves in
getting the jump on criminals. Hundreds of
beginners will learn how to shoot and how
to handle guns safely. Marksmanthip records will be assaulted historic trophies won
and national champions crowned. And at
the end of the three week bullet jubilee a
new group of straight shooting citizens will
scatter to the r homes to add to the defen
we proup of the nation and to the world
wide reputation of the I nited States as a
country of crack shots.

The sho ting starts Aigust 18 at the

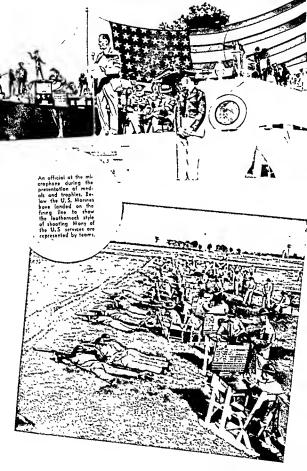
Army's Camp Perry a few miles from the lake town of Port Clinton O'to Nowhere else in the world experts state is there a rifle and pistol range that can compare with it Here stretched out is leby sile for two and a half miles are target ranges of every size from 1000 yards for 30 cal ber rifle competition to twenty five yards for pistol events. An around the fringe of the ranges is a far flung city of tents to house the extense Vrmy personnel required to run the matches and also to accommolate practically all the contestants and visitors.

For the matches are open to any chizen of the Unite I States and the Army will put up any Américan we wants to compete Tents heds and bedding are supplied with out charge while a mainmoth cafeteria serves meals at low prices For the rifle or pistol fun who would like to bring his family the Squiw Camp a part of the reservation next to the buthing beach is set asile. Here a min and his wife can have a loose I serence it ent with electricity for \$150 a day. Bringing junior along adds just fifteen cents a day to the tent cost.

And you don't even have to own a gun for the Army will issue you a 30 caliber rifle or a 45 caliber pistel and furnish all







the nation's greatest shots together with the dubs and rank tyros are standing satting kneeling and lying prone shooting riftee p stots and recolvers at various ranges in timed fire rap d fire and slow fire matches Playing asharphotor's swing time builets whistle through the air and rang into the targets or occasionally &c. which are the same than the ranget and spow with the waters of Lake Fre begond the builts.

the dual lag down back of the fir ng I ne or sight ing along the p to be had the targets you'll mar vel at the horder of Army of ficers and men needed to conduct all phases of the competition 'lou'll note target spot ters range officers accrees checkers computers and mes seegers In the pits seegers In the pits you'll watch enisted men haul argets do wn from their racks in the line of fire for check in great and replacement

Officials estimate that iff teen Army men are required for each ten contestants in order to run the matches in the smooth efficient and safe manner for which the meet is famed. An indication of hot Army subject so in makes for safety is found in the fact that only two casualt as have occurred in twenty one years of match fir

Down at the left of the range youll withess one of the most interesting phases of the Perry matches—the National Police School where representatives from police departments in all sections of the country are schooled in the latest methods of police seemee and sent back home as qualified in structors to their fellow officers in the home forces. Subjects studied in the full week course include disarrange and attacker shoot.





A hot gun battle in the Alley Since the fargets appear unexpect edly and varish in two seconds it takes good shooting to hit one

training is dramatically revealed by the experience of the Detroit Mich police who have sent representatives to the school for year's When they first started an average of four policemen lost started an average of four policemen lost started are average.

fire at an angle from left

The value of this police

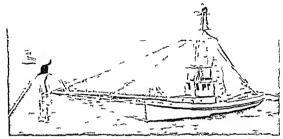
to right

their lives for every criminal killed in De troit Today the average is one policeman to every eleven criminals At the opposite end of the range from the Police School you run across hundreds of youngsters from eight to eighteen some of whom will shoot it out for the national jun or championsh p of the nat on and some of whom are barely by genough to holst a r fe to the r shoulders A U S Marine is as gued to each of these neophytes to give him expert astruction in the rud ments of rife shooting and gun handl mg Before the youngster comes out from under the w mg of his leatherneck gu de he will have learned not only how to shoot a gun and handle it apart and put it hack together and put it have together and tog

velopment of the art of shooting in all its phases from the instruct on of future sharp shooters to the rewarding of record break ing feats of marksmansh p the annual the state of the shooter of the shooter of the the estable shower of shooting as one of the most popular American sports. And now with national defense of primary importance Perry's influence may prove to have been of even greater value than that of a clean wholesome sport in building up the armed might of the United States



## Fishing Boat Steered from Crow's Nest



When the lackages and a school of fish he can sup the vessel loward t by cant als atop the mast

O've man can act both as pilot and lookout aboard the fishing boat Santa Licia of Santa Barbara Calif. In the crows nest of the vessel two control wheels are connected by means of long rods with the steering mechanism and engine below The pilot can thus steer his craft toward any school of fish he sights from his lookout.



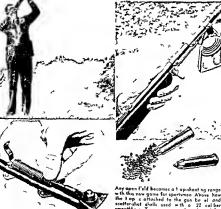
BicactEs can be con verted into motorized vehicles by means of easily installed units nust introduced rear wheel of the hi cycle is removed and replaced by the unit pictured at the left which includes an en gine drive mechanism small rear wheel and special luggage com partment Rated at one and a half horse power the four cycle air cooled motor is equipped with a kick type starter and drives the wheel at speeds un to thirty miles an hour running more than 100

miles on one gallon of

gasoline Power is transmitted to the rear wheel by means of a specially designed drive incorporating a chain and V belt transmission to reduce road shock and vibration Clutch and throttle are operated by finger tip controls on the handlebars

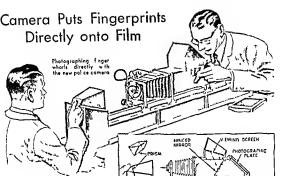
## Trap on Gun Hurls Clay Targets

WEIGHING only fourteen ounces and clamping to the barrel of al most any 22 caliber smoothbore or 410 shotgun a simple spring trap for throwing small clay tar gets makes possible an exciting new shooting game. The fore finger of the left hand presses the target release sending the clay disk skimming away while the forefinger of the right hand oper ates the trigger of the gun. At a d stance of fifty feet the tiny pellets of a 22 long rifle shot shell will break one of the clay disks According to the inventor I O Mossberg of New Haven Conn such one man trap shoot ing can be practiced safely in any 300 foot open field since the range of the shot is short.



.....

roothbo e Tap sping can be adjusted for reed and distance as llust ated at left



TO IMPROVI fingerprinting tech nique a Worcester Mass in sentor has developed a special camera to photograph fingers directly to obtain prints. The mulger places a finger ngainst one side of a prism

to obtain prints. The subject places a finger against one side of a prism set in to one end of the apparatus. Light from an electric bulb in a special housing silines in to the prism and reflects the finger image through the lens of an adjustable reflex type

How a built in light Illuminates the telliale print pattern

camera for focusing and photographing Side lighting brings out details of the print clearly while by sliminating the net I for an inking pad the apparatus removes the danger of smeared Prins

#### Bank Teller's Cage Has Fourteen Ways To Foil Holdups

No MATTIR What tactics a rob ber may attempt the teller in the agreed the depotent of the same depotent right has a card up his sleeve to foil him Installed in the demonstration room of a company man ufacturing protective devices for banks stores warehouses and other places of business the cage is equipped with fourteen separate electrical devices most of which are hidden and capable of secret operation while the teller apparently obeys the orders of his armed customer In the photograph the teller is shown operatlog an alarm button under the counter with his left hand while handing over cash with his right



By pressing a concealed button the cashier gives the alarm



ls It Murder?

By EDWIN TEALE

TFUYE minutes past eleven en the might of April 18 the crash and the quick double report of a revolver on the upper floor of a New York rooming house bodies of a nan and woman prawled on the floor both shot through the head Between the two where it appeared to have dropped from the stiffened fingers of the man lay a blue barriels, 22 calibre revolver Appar

How Scientific Sleuths Uncover Hidden Clews to Trap Clever Killers

Who Plot "Perfect Crimes"

ently, the tragedy was a murder and suicide.
That is the way the verdict might have

That is the way the ventor ingate have stood, but for one of the newest strings to the bow of scientific crime detection. In New York City as part of their regular procedure, detectives now obtain blood sumples at the scene of every crime of violence in this instance such samples quickly erased "suncide from the report and left the one omnous word "murder".

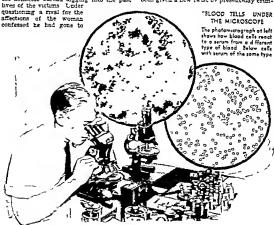
A laboratory detective, skilled in the use of serums, studied the blood samples with test tube and microscope. As a result of recent research at the Rockefeller Institute and in other laboratories seventy two groupings of fresh human blood are now recognized under the four main types A B AB and O Through the reaction of spec imens and serums the detective ascertained that the woman had type B blood the man type A. Samples of small, fresh stams on the floor of the death room, however gave an entirely different reaction. They had been produced by type O blood and could not have come from the life stream of either victim. A third, unknown, injured person had been in the room on the night of the tragedy'

That laboratory clew set detectives of the homicide bureau digging into the past the room, had been slashed in a quarrel and had shot both the man and woman. Then, after wiping fingerprints from the revolver, be had planted it to suggest a suicide

Oftentimes cunning and cold blooded killers seek to hide their crimes by such a ruse Exposing these murders daguised as suicides is one of the dramatic jobs of the scientific sleuth.

In this work, present-day crime fighters are making use of many of the resources of science. They are putting paper, hair rope handwriting fingerprints through a scien-tific third degree. They are employing spectroscopes to reveal the presence of metals and drugs. They are using polarized light to make crystal patterns stand out vividly under the magnifying lens. They are operat. mg comparison microscopes to bring the images of two bullets or bits of metal together so that scratches can be compared. In some instances the reaction of chemicals placed on a victim's hand has proved he did not fire the weapon he held. In other cases a comparison of revolver-barrel markings on bullets showed that the victim was killed by snother pistol rather than the one found clutched in his hand.

The old expression "Blood will tell" has been given a new twist by present-day crim-





#### DID DROWNING OCCUP IN SALT WATERS

Ry compound the amount of soft in the blood is pight and left rules of the beaut and the detection and determine whether a draws webs deed in feeth or and water The test often unmosts commods who have plonted a body is order counterfest a su cide crowded street below to hide his erime

One of the most inconfour advances in secent criminology is a blood test devised by the noted New York toxicologist Dr Alex. ander O Cettler tells almost infallibly whether a drowning section mat his death in rolt or fresh nater From the lungs blood goes directly to the left ende of the heart where It is numbed through

the circulation system of the body, returning to the right side of the heart Normally, this blood contains a certain percentage of salt. When drowning occurs in sea water, the lungs fill with brine

inclose in unreveling musteries of simulated suicide. Even the finlest drap of this vital fluid is often enough to reveal important clews that will lead to a solution

A few months ago noon hour shoppers in midwestern C12.12 acat. screamed and tered The body of a man had plunged from an upper story window of an office building It hurtled downward and struck the sidewalk The first doctor to reach the scene pronounced the men dead. evidently a sincide

Three hours later. this simple explanation was shattered by an alert assistant at the local morgue. He had noticed that there was no blood in the lungs. a condition characteris tic of deaths by falling The implication of that discovery was plain The victim had been dead before the fall from the office window A swift police investigation followed It rewealed that a decelute business associate after killing the victim had pushed the body from the window He had relied upon the speca tacular plunge into the



70

before death takes place and the salt content of the blood on the left side of the beart is increased. When death occurs in fresh water, this blood is diluted and so contains less than the normal amount of salt. Simply by taking samples from both sides of the heart and determining the salt content of each, the scientific sleuth now can prove instantly, in suspicious cases whether death occurred in salt or fresh water. In other drowing cases microscopic water-borne clews have heen instrumental in spottighting murder plots disguised as sucides.

COR example, a few years ago, boys out hunting gophers entered an old harn standing in a hayfield near a river within they found the body of an el derly man hanging from a crossheam All evidence pointed toward a suicide until a scientific detective set to work with his microscope Beneath the vic tim's finger nails and in his lungs, he discovered datoms or subvisible algae found in fresh-water streams and ponds This clew-too small for human eyes to

see—provided a key that unlocked the mystery of an amazing nurder. The elderly votum had been drowned. Then his clothes had been changed and his body hanged in the harn in what his slayers imagined was a complete obliteration of all evidences of

their guilt.

Sometimes the microscope joins forces with the test tube in exposing a suicide slaying In Ohio, not long ago,"a woman was found dead, poisoned by arsenic. Her hus-band contended that she had taken her own life, and exhibited a half-empty hox of vermin eradicator which he said she had used About this time, evidence came to light that, a Week before, he had purchased a different type of this same deadly poison. Had the victim met her death by taking the rat poison as he said, or had he murdered her with the arsenic he had bought? The answer hinged on tiny crystals found in the stomach of the victim. The test tube proved they were arsenic Under polarized light, the microscope next revealed brilliant triangular facets entirely different from those in the vermin compound. Tripped up in his story, and confronted with this evidence, the slayer confessed.

In the drug-crazed mind of an eastern deutst, some years ago, there hatched one of the most diabolical polson plots in the annals of premeditated nurder. His father-in law had taken out life insurance in his favor. To collect this money, the denist pretended to fill a large cavity fit one of the older man set beth Packing it full of the



To collect insurance a dentist filled a cavity with a deadly poison covering it with a temporary wax coating

deadly drug aconite be covered it with a tim temporary filling During the night, ins filling dissolved and the vectim died in agony before morning The indication, as the murderer expected, was that the dead man had taken his own life In analyzing the stomach content, how ever, a tordoologist discovered minute fragments of undissolved dental wax. Suspicious, he instituted an investigation. It resulted in the slayer a convection.

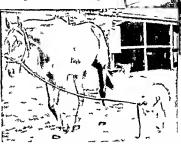
To sate precious munites in dealing with Borgia killers, scientific detectives in several large cities now employ spectroscopes to analyze unknown poisons. In a fraction the time required for chemical tests such mechanisms enable them to determine the drug that caused death. In the spectroscope, each chemical element produces its own distinctive limes of color.

N ADDITION to spectroscopes, to polarlzed light, to the more elaborate tools of scientific trame detection the investigation on the trail of a fake suncide slayer often has to devise original apparatus of his own to prove his point An outstanding matiance of the kind occurred during the celebrated "phantoms will case at Ladysmith, Wis

Shortly after a wealthy widow remarried she died of poison. Her bushand brought forth one of the strangest documents ever offered as evidence in a law court—a combined suicide note and will which had been written neither. (Continued on page 221)

### Canine Stable Boy Helps Train Racer

H GII STRUNG temperamental race horses often have mascots whose playful compan onsh p provides a diversion from the serious business of wining turf events. Witness for exampe the friendsh p of Baranca a thoroughbred and Flash a pure white dog In the eric at the right the



Fah the dag ma at leading Baan a aut to a wak in the cicle at uppe ght the ace ha e accept go so at fam hi son e fend

trained mascot offers the racer a ju cy car rot and at left he holds the halter and leads Baranca out for a 1 ght workout at the ringlewood Calif home Winner of ha share of races the horse could lead the dog a merry chase if he chose to set the pace natead of meek ly obeyng the or ders of his affection ate can ne trainer

## Pioneer "Seeing Eye" Dog Is Preserved

ALMO said to have been the first pol ce dog brought to this country as a see ng eye for the blad has been preserved as in life for his master Dr W A Chr stensen of Hollywood Cal f When the animal ded John M Schle sser Cal forn a natural st first measured h m both before and after the sk n was removed Next he modeled Almo in clay made a cast over the clay and ins de this cast. molded a form of pap er maché Then he fitted the sk n wh ch had been tanned and snothproofed over the form Finally he re turned the or ginal jawbone and teeth to the mouth Wearing he harness as shown at right Almo now looks as al ve as when he trotted across Hollywood street intersections ahead of his master



# **Champion Hunting Dogs**



in all parts of the country. An insulty bundreds of thousands of spectators watch various breeds of dogs such as pointers and setters heagles baset bounds dashshunds foxhounds spamels and retrievers compete under varying rules for honors and awards.

The whole purpose of a field trial is to

determine which animal possesses in the lighest degree qualities of value to the luntor. A field trial is not a beauty contest to pick the handsomest dog. It is not a race to see which animal can cover a given course in the least time. It is not even a competition to discover which dog can find the most game. The judges watching the animals at work ist their ratings under such head ngs as speed stamma style intelligence and courage.

Usually the dogs compete in packs or

in braces which consist of two animals run ning at the same time. They have from half an hour to three hours in which to cover a given area and find or retrieve game which has been released beforehand. The manner in which the dogs handle themselves in the field is the basis of the judges decision Centuries of breeding and years of scien tific training comb he to produce the win

The earliest dogs to compete in American field trials were positives and setters animals which rigidly point toward game as soon as they seen it. Such consistants are still among the favorites of field dag fanciers. To watch these bunning dogs is action. I recently drove to Canton. N. J. where the Jockey Hollow Clust was holding one of its celebrated field days for field dogs.

Two black and white pointers were zig zagging through the weeds when I drove up to the 1000 acre state owned shooting grounds. In this type of competition the dogs bunt for pheasants or qual released on the course At Cinition the three mile circuit ranges through open fields along a bush covered hillside through heavy woods and out onto a towland meadow cut by a winding stream Handlers do rect the dogs while the judges follow close behind on horseback:

close behind on horsehack
Along the hillside the black and white
pointers cut sharply back and forth while
the handlers called them in or urgsd
them out with sharp blasts of their

whistles One hiast usually means Come in two blasts Go on To elim mate confus on handlers often uss whistles of differ ent putch

While the dogs are work ing westward through hrd Hant hued bushes the judges are jotting down their notes watching especially such points as thoroughness and scenting ability The latter quality is of prime importance

The latter quarty is of prime importance.

A few years ago a brilliant young po after
suggle season. He seemed destuned to be
come one of the greatest dogs in field trail
bastery. Then at one contest, an insufficent number of kennels was provided. The
young dog was kept overnight in a garage
and during the evening somone carelesty
rin a motor. The fumes from the exhaust
affected the delicate nose of the pointer

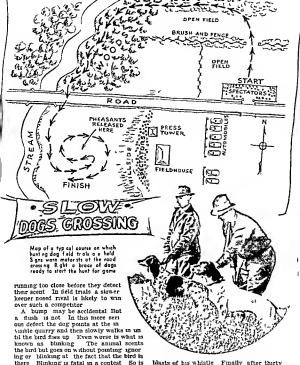
Some dogs trainers have found are too fast for their noses They continually bump birds scaring them into the air by





HOW TO MAKE

Somet mes pheasants a e t ed n patches of b wsh for dogs to f nd To make them stay quet they are t st made dry by tucking the r heads unde the rwings and whiling them oraund as shown at the left



flushes a bird at which the other dog is pointing How long a bird dog will remain rigidly pointing at the spot where he scents game is a question hotly debated among sportsmen At one recent meet a trainer lost sight of his dog He hit him again and again with

forth in front of its rival or rushes in and

Here the dog cuts back and

blasts of his whistle Finally after thirty five minutes of searching he discovered the animal standing rigid among thick bushes pointing at a clump containing game birds

The distance at which such dogs can catch the scent of the quarry depends upon weath er conditions as well as the direction of the wind Some years ago in England a noted dog trainer named H M Budgett made ex haustive tests of (Continued on page 217)

interference



# Here's My Story



DAVID SARNOFF SPENT THE FIRST NINE YEARS OF HIS LIFE IN WEST CENTRAL RUSSIA, WHERE HE WAS BORN ON FEBRUARY 27, 1891



WHEN HE WAS NINE YEARS OF AGE, HE CAME WITH HIS FAMILY TO THE UNITED STATES YOUNG DAVID WAS THE ELDEST OF BIVE CHILDREN



THE DEATH OF HIS FATHER A FEW YEARS LATER MADE HIM THE FAMILY BREADWINNER, SO HE STARTED SELLING HEWSPAPERS IN DOWNTOWN NEW YORK CITY



TO SUPPLEMENT THE SMALL AMOUNT HE MADE SELLING PAPERS, HE GOT A JOB AS MESSENGER BOY FOR THE COMMERCIAL CABLE COMPANY



FINALLY, HE LANDED A FULL-TIME JOB, AT \$5.50 A WEEK, AS A MARCONI COMPANY OFFICE BOY AT NIGHT, HE PRACTICED CODE ON AN OLD SECONDHAND TELEGRAPH SET



IN 1908 HE GOT HIS FIRST ASSIGNMENT AS A WRELESS OPERATOR IN THE LONELY MARCONI STATION ON NANTUCKET ISLAND OFF THE COAST OF MASSACHUSETTS HE SPENT HIS SPARE TIME IN THE STATION LIBRARY READING TECHNICAL BOOKS

# THE INSPIRING CAREER OF DAVID SARNOFF



HE WANTED TO STUDY ELECTRICAL ENGINEERING AT PRATT INSTITUTE IN NEW YORK SO HE ASKED FOR ATRANSER TO THE SEAGATE NY STATION THIS MEANT A FIG CUT IN SALARY BUT SHORTLY HE WAS PROMOTED TO STATION MANAGER



WHEN HE WAS TWENTY YEARS OLD HE SERVED AS WIRELESS OPERATOR ABOARD THE SS BEOTHIC ON A SEALING EXPEDITION IN THE ARCTIC



IN 1912, AS A NEW YORK MARCONI STATION OPERATOR, HE PICKED UP WORD THAT THE J J J 7774//C WAS SIKKING HE STAYED AT HIS KEY FOR 72 HOURS AND GAVE THE WORLD THE FIRST AUTHENTIC NEWS OF HE DISASTER



WHILE COMMERCIAL MANAGER OF THE MARCONI COMPANY IN 1915, HE RECOMMENDED DEVELOPING A RADIO MUSIC BOX" THIS TURNED OUT TO BE THE FORERUNNER OF OUR MOOREN HOME RADIO RECEIVERS



IN 1919, THE RADIO CORPORATION OF AMERICA ABSORBED THE MARCUNI COMPANY, AND SARNOFF WAS MADE COMMERCIAL MANAGER OF THE NEW, ENLARGED CONCERN



AT 39, DAVIO SARNOFF BECAME PRESIDENT OF RCA TODAY HE ALSO HEADS THE NATIONAL BROADCASTING CO. ISA DIRECTOR OF THE METROPOLITAN OPERA AND OTHER IMPORTANT DREANIZATIONS, AND HOLDS MANY GHORRARY UNIVERSITY DEGREES



#### Hot-Air Cabinet Dries Fire Hose

AN AIR CONDITIONED cabinet of new design makes about work of drying fire hose Drawn into the machine air passes over electric heaters and then circulates through the loosely to eld hose resting on shelves The indirect heating is said to avoid possible damage to the hose and the unit awares the time and work of hanging it up is a drying tower

#### Fountain Pens Kept Clean by Chemical Bath

CHEMICAL baths for fountain pens are claumed to clean the parts and keep the rubber sacs in good con dition. When a measureful of the fisky white clean make the clean man and the clean control man and the pens is immersed in the so lution which is deruited brough the interior by working the soft filling lever A can of the cleaner holds enough for fifteen baths



Flushing a fountain pen in the solution of chemical in water

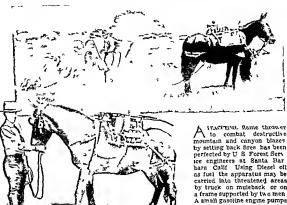
#### Oil Heater and Stove Cambined

ESPECIALLY suited for cab ins of small boats where space is at a premium a one burner kerosene stove and a radiant beater have been combined in a single compact assembly For use as a beat er the burner is fitted with a perforated iron ball which becomes intensely hot A concave reflecting surface concentrates the heat rays in the desired direction In the accompanying photo the convertible unit is shown as a stove and as a heater



Attachments conve t the oil stove at the left into a ad ant heater

## Flame Thrower Helps Fight Forest Fire



Mule loaded with portable outfit for storting back fires it sprays flaming of an alass or leaves as flustrated above sprays floming of an glass or leaves as

to combat destructive mountain and canyon blazes by setting back fires has been perfected by U S Forest Serv ice engineers at Santa Bar bara Calif Using Diesel oil as fuel the apparatus may be carried into threatened areas by truck on muleback or on a frame supported by two men A small gasoline engine pumps the fuel through a forty foot line to the nozzle. In a recent five hour test, the machine sprayed forty five galions of oil enough to start a back fire several miles long

#### Addressing Machine for Hame or Club

AN INEXPENSIVE new address pg machine serves homes churches clubs and small businesses whose correspondence frequently goes to the same mailing list Stencil cards prepared on a typewriter give as many as 10 000 impressions apiece For use up to sixty five stencils are placed at once in a hopper at the left of the machine. The user then places each blank envelope in turn against a guide uses a finger tip shift to flick a stencil into position beneath an inked roller and depresses a printing handle. The method is said to produce neatly printed names and addresses at eight times the speed of hand ad dressing



This device speeds addressing envelopes to maing lists



## Lightweight Plane Motor Has Few Parts

INVENTIONS



DISPENSING with a carburator a radical new airplane motor has been designed by Charles A and Victor Tore of Houston Tex Using half as many parts as a standard motor, they claim it will develop twice the horsepower with the same displacement and less weight. In addi tion they call their engine inexpensive to build and well suited to mass production The two brothers have offered it to the U S Government which recently has created a special board of experts to pass audment upon the military usefulness of civilian inventions

patterns Despite its wire frame the hat as hight in weight

# Transparent Clarinet and Mouthpieces



the music comes out if you play a clarinet of

transparent plastic material like the one being examined by Paul Whiteman famous orchestra leader in the photograph above While the entirely transparent clarinet is still something of a novelty mouthpieces of the

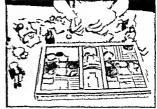
new material are now available to clarinet ists for use with conventional instruments of wood or metal Light in weight, the trans parent plastic mouthpleces are said to be dur able and proof against warping and splitting

### Electric Stop Watch Is Eosy To Read

USABLE wherever it can be plugged into a 110 voil A C electric outlet a novel electric stop watch has a counter like the odometer on your car This makes it easy to read time in inter-als as small as one tenth of a second up to 10 000 seconds or about two bours and forty s x minutes Press ag but ton sets the timer back to zero



Time a recorded on direct reading counts



## Sponge-Rubber Building Set

FIGURES of birds animals trees trains and other objects can be constructed from novel blocks made of sponge rubber. Put up in kit form with a supply of rubber cement and a wooden spreader the dle cut rubber blocks are designed as an instructive and entertaining toy for children of all ages.

# Paper Made from Clay





war use has fust been developed at the Massachusetts Institute of Technology While various kinds of it may be applied in familiar ways—as in transparent wrap ping sheets and milk containers-the min eral paper is far more than a substitute for wood pulp or linen paper In printing its ultrafine texture unparts

new clarity and detail to half tone illustra tions Waterproof and nonabsorbent it gives a much higher gloss than common paper Unaffected by age it may be em ployed for permanent records

Its fibers can be made into filter cloth

Other uses milk containes threads ac aproof titer cloth

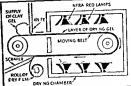
and molded ports for motors

invaluable to chemical industries because of its resistance to corrosive acids and al kalles. A flexible sheet form can be wrapped around electric cables for insulation

For mica a strategic war material used meterrical parts of autos planes and radio year function and a many strategic and a many strategic parts from a many strategic at most clay paper has the same chemical composition and electrical insulating qualities stiff sheets of it should make an admirable substitute

substitute
Called alsislim the new paper takes its name from the first letters of alumnum and silica These are the constituents of Wyo ming bentonite a type of clay that serves as raw material for light brown inheral paper. Another kind of bentonite from California yields white faper.

Ground to fine powder the clay is may pended in water while grit and foreign mat ter settle mit. Evaporated to z jellylike mass the res due then is chemically treated according to the desired use. Ultramicro scopic mineral fibers mat together during the process as fibers of ordinary paper do



PAPER FROM COMMON CLAY

Howap apa ad cloy s tu nad ato pape. The v aw at r ght shows the mot ted m croscop c m neral f bers



# Trucks Aid War on Mosquitoes

SING trucks of new de sign motorized mos quito fighters now help rid Suffolk County N Y of the insect peats Cue type of vehicle allows an operator to unlimber a long handled spray gun for applying figuid to atag mant pools of water in street drains without leaving h seat. When not in use the gun is carried in a handy rack at the s de of the mach ne A larger



truck carries a crew for more extensive spraying operations afield in a determined cam pagn to make the marshy tracts of outlying Long Island unin habitable as breeding grounds

pa gn to make the marshy tracts of outlying Long Island unin habitable as breeding grounds for mosqu toes and so render it more habitable for humans dur ing the summer season



Workers removing evets from dry see bases for smmed ate use in plane

### Refrigerators Keep Airplane Rivets Fresh

RIVERS for use in build ing giant four engine bombing planes seventy four passenger shine and thirty three passenger high altitude transport nlanes stored in special refriger ator cabinets in a Scattle Week simiane factory Made of aluminum alloy the rivets are first sub sected to a heat treat ment in a special unit built for the purpose and then transferred to stor age chambers maintained at a low temperature by solidified carbon dioxide or dry ice The cold treatment is said to re tard the aging or harden ing of the rivets and thus keeps them indefinitely in the preper condition for driving Rivets are taken from the cold chambers only as needed and are driven into place

within fifteen minutes

## Star Charts Make Midget Planetarium



## Toy Balloons Help Opera Singer Get More Lung Power

DEVELOPING the lung power required to throw an aria into the back rows of the top gallery is a problem that Hilda Burke New York opera singer solves by the curious expedient of blowing up toy ballons As part of her practice sessions supple menting lessons in voice train ing Miss Burke Inflates half a dozen or more balloons every day Balloon blowing she believes not only does a great deal to strengthen her lungs, but also tends to enrich her vocal tones At the right, she is seen engaged in the novel exercise



Hilda Buike giving her tungs a work out by blowing up bolloons



Memorandums put under the flap are always visible

## Transparent Writing Flap Tops Off New Desk Cover

Mast in two sizes for office or home use, a new desk cover is equipped with a top flap made of fireproof transparent material that provides a smooth writing surface Being hinged, the flap may be raised to permit use of the blotter boneath Calendars, memorandums, and other reference material can be placed underneath the flap

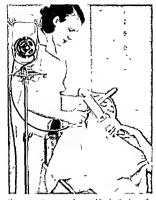
### Vibrating Brush Provides Efficient Scalp Massage

DESIGNED to massage and brush the scalp to stimulate natural hair growth an electrically powered scalp brush now on the market inbrates at the rate of 5000 times a minute Made in models for both professional and home use the brush is said to perform in three minutes a brushing that would take fifteen or twenty minutes if done

by hand The brushes are driven by means of a flexible shaft connecting the brush head with an electric motor Opening two clamps on the side of the brush head allows the user to remove the brush for cleaning and sterilization Monthly oiling is the only maintenance the outfit resulters



tles at left move 5 000 times a minute



New massage device in use. Paper poddles slop the skin gently

### Paddles Provide Cool Massage

WHIRLED by a flexible drive shaft connected to an electric motor, paper paddles in a new motor, paper paddles in a new According to the inventor, the paddles create a circulation of air around the area being massaged thus overcoming the objection of beat created by the massaging action. The device is intended for use by operators in beauty pariors and barber shops

# Standard Musical

MISICIANS who wish to check the tuning of their misruments can now do so by tuning in on WWV, the radio station of the National Bureau of Standards at Beltsville, Md The standard for musical pitch, 440 cycles a second for A above middle C, is broadcast twenty-four bourseless of the standard that the standard program of the standard programs are on the stream programs are on the str

# Adjustable Sun Glasses Regulate Light

SUN GLASSES recently introduced can be adjusted by the wearsr to admit more or less light, according to the brightness of the sun and its resected glare The sun spec tacles utilize special lightpolarizing glass (PSM, April 36 p 20) Each eye of the wearer looks out through two special lenses The lens nearest the eye is stationary, while the front lens can he rotated by pushing a small hutton on the bridge of the spectacle frame When the button is moved to the extreme left, the maximum amount of light reaches the eyes, but as it is pushed back toward the right, light penetrating the lenses is cut down until they are so dark that the brightest possible beach scene may he viewed without discomfort Special louvered plastic side shields block out annoying reflections

by noteing the outelement of these and these rough
glarge o user can
offer any amount of a
pictured of the laft
prictured of the laft

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POPULAR SCIENCE



## Gold Plating on Glass Makes Navel Jewelry

GLASS BEADS plated with gold or other metals are now available necklace pictured above is made of glass tubing, chopped into beads strung and plated by dipping into a special solution It is said that the plated beade will not tarnish or leave marks on the skin

# Safety Razor for the Feet Trims Corns and Calluses

CORNS and calluses may easily be trimmed with complete safety, it is claimed, by a new type of corn safety razor Made with a molded plastic handle, the tool is equipped with a surgical-steel blade ahaped to fit a metal guard in such a way that only the exact shaving space

necessary to pare corns is allowed be-



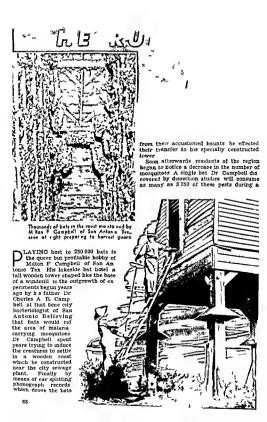
### Cigarette Case Keeps Account of Smokes Given to Friends

A NOTEL cigarette case keeps tabs on the cigarettes your friends 'borrow' When you want n smoke yourself, press one button to open the case But when an acquaintance 'bums a cigarette press a second button This not only opens the case but operates a counter built into the case



When somebody cadges a smoke, press a special button to apen the case A counter registers the gift, keeping track of those given away





# HOTEL FOR BATS

At dusk, bats swarm out in clouds to feed on disease bearing mas quitoes. At the right is a full grown specimen Dissections have shown that one but will consume thousands of the insects a night

single night a feeding Since its introduction, the Campheil bat roost has been a source of revenue as well as a laboratory for the study of the strange little creatures it bouses Visiting bats tens of thousands of them that choke the interior and often hang in great bunches from the outside eaves pay their rent by adding to the accumulation of guano in the roost

Once a year, Campbell cleans this deposit from the interior, raking it down a chute at the bottom and sacking it up for sale Bat guano is said to be a nearly perfect fertilizer Sampled and labeled, as required by law it sells for from five to ten cents a pound Last year, the roost yielded nearly 6 000 pounds of guano In fact, so profitable has the



unique venture become that quantities of the special ture used for attracting bats and detailed plans for establishing similar roosts. bave been sold to prospective bat raisers in several parts of the country, with an eya to both profit and mosquito control



# Artist Makes Faces of Avocado Seeds as Lapel Ornaments

PROBABLY the only avocado-seed carver in the world is Karl Busch, a Hollywod movie studio artist whose hobby is turning the seeds into odd little faces to be used as lapel orna-Already, Busch has produced more than seventy-five of the oddities Originally, the seeds are soft and easily worked After the carving is completed, Busch places them in the sun for curing When they are almost as hard as ivory, be paints them with hright-hued water colors and applies five coats of lacquer which give a high gloss and preserve the material almost indefinitely against rot

# Tiny Museum Holds 25,000 Rare Items

DRTY years ago Frank S Van Den Bergh a returd estate supernn tendent of Santa Barbara Calif sent a shell he had picked up to a phy sican in Japan In return he received a shell from the Orient That was the be ginning of e remarkable one room mu seum holding 25 000 specimens most of them acquired by trading

Excepting for short trps Van Den Bergh has never traveled in quest of specimens By correspondence he has assembled from eleven different coun tress the 15 000 shells and the 10 000 mie selleneous items which cover the walls and culing of his wieve by twenty foot museum



Fronk S. Van Den Bergh shows a skull of a prehistoric lad on unsorthed near his Santa Barbara. Colif home

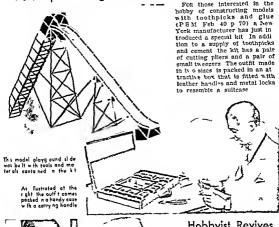
Besides 7000 arrowheade he has ancient skulls from the Southwest and a rare Indian boomerang used by an early American hunter centuries before

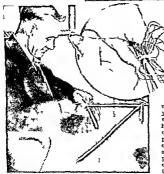
the coming of the white men One unusual con tribution from the Orient ie a miniature reprodue tion of India s famous temple Tay Mahal It ar rived smashed and had to be carefully repaired Among the vast col lection of shells in his Tom Thumb museum Van Den Bergh has specimens hardly larger than sand grains and others so hig they once hmsed Australian clame that weighed 100 pounds How much his complete collection is worth he can only guess One shell alone a rare Voluta from would bring \$200 Recently Van Den Bergh parted with seven shells for twenty five do! lars-the first cash sale he has made since start ing his museum

By t ading with ather collectars in two hem spheres the habby structed this small roam ental a private museum with 25 000 rare items.



# Toothpick Engineers Get Building Kit





Eugene Barnett engaged in his unusual hobby. The horse har is woven an a round dowel rad as shown in a rele

### Hobbyist Revives Old Indian Art of Weaving Horsehair

MANING beits bridles har ness whips and other articles of horsehair is the unusual holby that Eugene Barnett of Grangeville Idaho has turned into a paying business The art of weaving horsehair once practiced by the Indians

was revived by Barnett some thirty years ago and he has been doing it ever since Black horsehair as well as hair dyed in various colors is woven on a round done it not as shown in the photographs at the left. Horsehairs of various colors make it possible to achieve interesting and decorative patterns in the finished work. A beit or bridle woven on the rod comes off in errollar shape when finished and is then pressed out flat Barnett gets unusually high prices for his work.

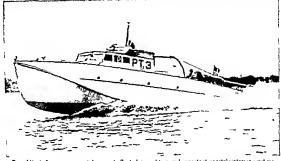
# Composer Collects Music Boxes

COLLECTIVE old and rare music boxes is the interesting hobby of Paul Taubman I ction rated among the finest privately owned in the world includes such ware ifeing on the worms have that executions a house. nume and a hind owner on instrument that emits burd trills and was once used to teach canary birds to sing Another is a master piece of ingenuity Driven by a spring mo-tor it plays eight different

tunes and can be set to re nest any selection or play the times in any desired sectionce The instrument also boasts a wallime adjuster have and tre hears a fixe fortenn and ald regulator Taubman picked at up for twenty five dollars and vetues it now at nearly \$10 000 Interest in these mit in one led Taubman to masber the art of playing a plane and an organ at the same time as nictured at the left



# Fast Patrol Boat Mounts Heavy Armament



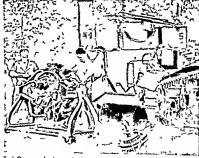
One of Uncle Sams experimental mosqu to fleet designed to guard important coastal waters in wart me

MALLEST of the U S Navys againing craft the fifty nine foot coastal motor boat PTs carries formidable armament into action at racing speed. With thirty aimidated boats ranging up to eighty one foot length built or building it will form an expeniental mosquito fieet armed with torpedoes depth charges machine guns and smoke screen generators. The boats can be turned

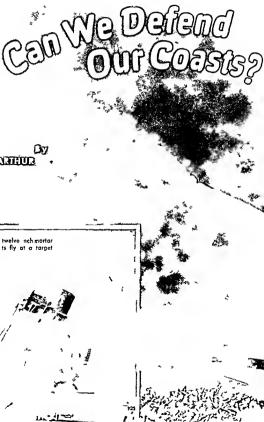
out rapidly by mass production. A potent threat to submarines and surface warships alike they are intended mainly for patrol ling such naters as Chesapeake Bay Putter Sound and the mouth of the Mississippi River. By taking over these duties they would release destroyers for operations far at sea. The name PT3 is the Navy's designation for patrol torpedo boat No. 3

# Tank Engines Are Repaired in the Field

ENGINES of radial design like those of airplanes propel mili tary tanks of the U S Army Quickly de mountable for repairs the motors are easy to overhaul in the field as shown at the right. The scene took place at recent ma neuvers of the U S Army Tank Corps in Louistana Shortly after the picture was made the speedy mechanized unit was rolling on its way



Tonk Corps mechanics overhauling a rad al motor in recent Army maneuvers



# A GLIMPSE OF A LITTLE-KNOWN BUT VITAL LINK IN NATIONAL DEFENSE—THE COAST ARTILLERY

OST people think of the Navy as our first line of defense In one way it is and in another way it isn t. Its mafor war job would take it on an offensive mission-to head off and defeat an ap-proaching enemy fleet far from our home shores Stringing out the big-gunned ablps for close in defense of our long ocean frontier would make their offensive use impossible, would abandon the seas to the adversary, and would surrender our overseas possessions and our maritime routes for obtaining vital war supplies. Our widely scattered warships would be push-overs for a concen trated hostlie fleet. Therefore our abips of the line must be kept together, regardless even of the off chance that fleets in the Atlantic and Pacific might attack us simultan-

So if the word defense is used in its narrower, close to home sense the U S Navy isnt a defensive weapon at all Our first line of defense becomes the Army's Coast Artillery Corps Its seldom written-about solders man the big guns that defend the Panama Canal the Navy's billion dollar service station in Hawaii and our principal barbors and seaport cities located on the mainland

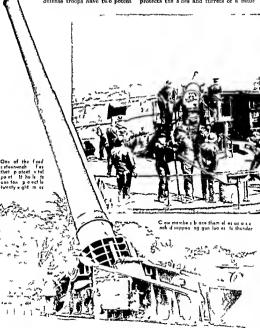
There aren't and there never will be, enough guns in America to cover all our many thousands of mlles of seacoast Fortunately, that sort of defense isn t necessary To have any real chance of success a modern invading army must control wellequipped ports of disembarkation Soldiers aometimes can be landed on an open beach, but it is next door to impossible to land tanks large caliber field guns and all the other heavy material which is essential to present day mechanized warfare without adequate facilities So the chief wartime responsibility of the Coast Artillery would be the protection of the United States against invasion by keeping our important scaports safe against capture

Other of its numerous duties would be guarding our thickly populated coast cities against bombardment by enemy warships protecting the Navy a bases and defending the fortified strong points in our system of seacoast defense which would allow our



mobile ground Army and Air Force to re main concentrated for quek action aga ast an invade who took the long chance of land ing on some unprotected beach. To both the Navy and the Army the harbor defense at lifery is as invatuable as a good goale is to a lockey team and for the same reason—by playing Kitty bar the gate it gives the reach of the team freedom to at the control of the team freedom to at

To do their work of protecting us against invasion or bombard ment from the sea our harbor defense troops have two potent weapons—big guns and submarine mine.
The king pins of their armament are the
mighty states inch guns—as large seasons
guns as there are in the world except for
a few eighteen inchers which the Brita
have mounted in their Singapore defenses,
eight miles—the range of a state in inche gun
mounted in a battleship turret is about
twenty miles—and at somewhat shorter
tranges their one ton no ickel chrome armor
percung projectiles will perforate even the
thick and tough face hardened armor which
protects the a des and turrets of a battle



ship, and burst in the ship s vitals with effects likely to be deadly Operated by electrical machinery, they can be fired for indefinite periods at an astoundingly high rate of speed. It is these mighty weapons which are most depended on to keep any hostile fleet well out of range of the vitally important locks of the Panama Cansl, the navai hase at Peari Harbor in Hawaii, and cities such as New York and San Francisco

Disappearing guns, in which the recoil throws the gun back to loading position behind a parapet and counterweights bring it back into firing position, aren't being built

these days because the design of their carriages makes it impossible to give them sufficient elevation for long-range fire But we have a good many of them in our coast defenses, and their 1,560-pound projectiles have what it takes to sunk a battleship - if the battleship obligingly comes within their range of ten maies Another of our coastdefense weapons whose game is the capital ship is the twelve-inch gun. with a range of seventeen miles The high angle plunging fire of the twelveinch mortars mounted in many of our coast defenses is dangerous against the deck armor of any ship which ventures within their eight-mile range Batteries of teninch and six-inch guns, which have ranges of about eight miles, are for use against cruisers, destroyers, transports, and other non-capital ships A hit in a vital spot hy a sixinch gun will put a destroyer out of action Three-inch rapid-fire guns, which have a range of alx miles, are used to protect mine fields

Ail our fixed seacoast guns are mounted in harbor defenses, but not all of them are protected by concrete parapets or bombproof emplacements Against the growing menace of the bombing airpiane, concealment is considered even more important than protection. and some of our newest big guns are mounted in the open and depend on clever camouflage for comparative safety Antiaircraft guns, both fixed and mobile, are provided for the protection of the hig guns and the men who fight them from attack from the air

Railway artiflery is equally valuable for supporting fixed guns in the defense of fortified positions and for use against an invader attempting a landing at a place not protected by permanent coast defense but within a reasonable distance of a railroad line Fourteen-inch railway guns have a range of twenty-four miles their joh is to attack an invader's hattleships and big cruisers. Eight-inch railway guns have a range of thirteen miles and are for use against lighter warships and transports Raliway artiiiery has the important advantage of what the soldiers call 'strategical mobility"-aithough it can t be moved very fast, it can be moved from one coast to the other

Regiments of 155-millimeter tractordrawn guns-the same type of heavy gun that is used by our Field Artillery-also are part of our coast defense system. They are capable of fairly high road speeds, and they

do not require previously prepared positions. Their range is about

ten miles

Both railway and tractor guns are bighly important weapons in the defense systems of the Panama Canai and Hawaii

Much less spectacular than the Coast Artillery's big guns, but every bit as important for the defense of our harbors, are its fields of submarine mines Mine fields are carefully planned in peacetime, the mines and (Continued on page 218)



The men behind the guns Coast Art Kerymen loading a railway mortar at target practice



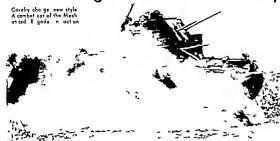
SEPTEMBER, 1940

# Coast Guard Patrols Sea Lanes

O KEEP an eye on all vessels approach the Gulf of Mexico a milar patrols are also ing our portheastern coast two mile a being carried on At present more than m nute flying boats from the U S thirty long saure Coast Guard flying hosts Coast Guard stat on at Floyd Bennett Field like that chown in the illustrations on this New York City are combing the sea lanes in swift patrols. The flights carry them over nage are engaged in the work an ocean heat that extends from Rhode Is iand to Marviand Taking off in 1 700 horse nower Hall biniane flying hoats that have a range of well over 1,000 miles or in twm motored Grumman shins that cruise at 125 miles an hour the pilots and observers often head far out from shore When ever a vessel is sighted the winged ship swoops down and circles until identifi cation is complete Should there be any thing suspicious about the craft a re port is flashed by radio to shore head guarters From other Coast Guard bases on the Flastern seaboard and on The plat hands his rad a apera tor a message for headquarters seport nd a susp cous vessel

Flying boot aircling a ship for identification. Map is a report showing vessels sighted on patial

# Grooming the Iron Cavalry



### By ARTHUR A. STUART

LD Bedford Forrest the bewhiskered Confederate can arry leader is said to have remarked that the way to wan in war is to git their fustest with the mostest After three quarters of a century on one has succeeded in evolving a more generally useful receipt for winning battles Aft Fort Knor twenty odd miles from

Lousville Ly is statuoned the Army a most modern Im plement for gitting that fust est with the mostest—the fast moving and bard bitting mechanized force which is despirated officially the Sev with Cavalry Brigade (Mechanized) but which the Army prefers to call the iron cavalry

In the supermodern caval ry the armored fighting ve blick has taken the place of the horse commands snap out of radio receivers instead of the place of the pets the staceato machine gun has superseded the gleaming saber and the monkey wrench has taken the place of the pitchfork But in spite of all these changes and innovations the iron cavalry still is cavalry. The troopers talk about engines and transm saiou systems instead of about horses an is addles but they are trained to think fast and to act fast



and boldly and so to carry on the great tra

The iron cavalry has the true cavalry on mt and it is armed southned and trained to do the traditional mark of country in war -to carry out distant scouting missions to core critical nos tions and hold them intil the infantry has time to come up to guard the armys flanks to attack the enemys flanks and go swinging around them to raid his communications and destroy his surmiy denots to pursue a heaten enemy. When conditions of ground and weather are fa vorable for its use the Mechanized Brigade is best suited to do many of these things because it can go farther faster and but harder when it gets there than can horse cavalry

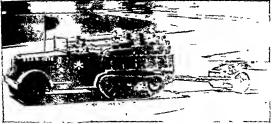
The Mechanized Brigade consists of a

anized reguments of cavalry a battain of field artillery which has four motor drawn firing hatteries each of our 75 millimetr howitzers an ordinance maintenance company for the fighting vehicles and a quarter master maintenance company for the trucks and other vehicles a signal detachment for radio communication a medical trop and a communication a medical trop and a reason authorized strength is about 2000 nen but it is hoped to double its attength which is men and fighting vehicles.

THE backbone of the mechanized forces fighting power is its armada of 112 com bat cars—two two troop squadrons of them

in each of the cavalry regiments
Cavalry combat cars are light tanks with
full track laying mechanism. They have the
same engineering features which make our





"Bringing up the guns. The gun crew rides in the same vehicle that tows the 75 millimeter howitzer

and drive, and long-wearing tracks of rubber composition set in steel blocks which have proved that they can stand up under even the intense heat generated by the friction of long, fast marches over sun-baked southern hill roads A few of the combat cars have Diesel enrines.

Weighing nine and a half tons, the comhat cars-the troopers call them "hell buggies"-are a couple of tons lighter than the infantry light tanks, and they are faster and more maneuverable. Their top road speed is better than fifty five miles an hour, and they can "cruise at forty-five miles for long stretches without unendurable strain on either machines or creas Cross-country, their top speed is considerably in excess of twenty miles an hour over average ground, and their obstacle climbing is spectacular Because of their lighter weight, their armor isn't so thick as that of the infantry tanks The iron cavalry is willing to sacrifice some degree of protection to get more speed.

Another feature in which the combat car differs from the infantry tank is that it has one correct instead of two, and that its guns may fire in any direction. The crew consista of four men and the armament of one 59 caliber and three 30 caliber machine gunsone of the latter in an antisircraft mount. Each car also carries a Thompson submachine gun for close quarters fighting, and cach crew man is armed with a 45 caliber automatic pistol This heavy armament gives the combat cars tremendous fire power They also may he used as shock weapons They won't be wasted in an attack on an enemy's carefully prepared main position, but when the right opportunity for their use arrives their thundering, lurching advance in fire spitting waves will be the machine-age version of the boot-to-boot charge of yelling, saber brandishing troopers

In addition to its two squadrons of combat cars, each of the mechanized cavairy regiments has a reconnaissance troop and a machine-gun troop

The job of the reconnaissance troop is acouting—sepicially long distance scouting. One of the regiments is equipped with scout cars for this purpose, and the other with armored cars. The scout car is a fast, fourwheel drive vehicle with high sides of light ammor It carries a crew of from six to eight, and its armament consists of three machine guns mounted on a rail running entirely around the car's top, giving the gunners an alt-around field of fire. The armored car is a six-wheel, rear-drive vehicle closed in over the top by a turret.

The business of the machine-gun troop is to cover the advance of the combat cara with their fire, and to give the iron cavalry increased defensive power when it is necessary for it to hold a position against an attack. The machine gunners do most of their fighting on the ground, but they ride to the scene of action—the troop of one regiment in scout cars, and the froop of the other in half-track personnel carriers. The latter are light tracks with the rear wheels replaced by a track-laying mechanism

ANOTHER distinctive type of comhat vehicle used by the Mechanized Brigade is the mortar mount, a specially huilt fourwheel armored truck carrying a smoke mortar which its crew can dismount and set up to ky down a smoke screen to cover the advance or withdrawal of the brigade

Motor cycles are used for various purposes, their riders being armed with rifles or with the submachine guns which the troopers call "Tommy guns"

To keep up with an outfit which can move as fast and as far (Continued on page 222)



# U.S. Army Gets a New Anticircraft Gun

bombers as well as hedge hopping attack planes the antialreraft gun pictured in action in the photograph above is one of the U.S. Armys newest weapons for defense against possible enemy air attacks. Capable of being towed from one position to another at high speed, the thirty seven millimetergun fires at the rate of 125 shells a minute Each projectile weighs one and a third pounds.



Rear view of the torpedo in ne Sound waves guide it to its prey

#### Electric Ears Aim Odd Torpedo Mine at Enemy Vessel

HUNTING ats prey with electric ears another version of the some torpedo (PSM Mar '40, p 78) combines features of a mine and a torpedo Four feet long and weighing 150 pounds the torpedo-shape unit has twin propellers and a rud der In use, the weapon is anchored under water By means of an electrical mechanism, the noise created by the propellers of an approaching ship causes the mine to release its anchor and starts is propellers whirling Guided by the sound waves set up by the ship the torpedo-mine steers straight at its objective ex ploding on contact.

# Model Shows Tooth Formation



Tracing projected cross sections (tap) and cutting them out of plastic

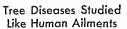
O DEMONSTRATE their discovery of the exact manner in which enamel is formed on teeth Dr Moses Diamond and Joseph P Westmann of the Columbia University School of Dental and Oral Surgery recently constructed a novel plastic model of an embryo tooth which is exactly 100 times the size of the original The

onto tracing paper, en-larged to 100 times their size These projected images were traced on the paper which was then laid over sheets of a special plastic material By gentle hand pressure the tracings were transferred to the surface of the plastic, and the outline cut out with a knife Cross sections of the original tooth varied in thickness from two to five microns or thousandthsofamillimeter. so the plastic enlargements were therefore made from 200 to 500 microns thick When the entire number of cross

sections had been completed they were placed one over the other in the same respective positions as the original tooth sections thereby producing the tooth model. Two and a half feet long the tooth model has its upper half hinged to the lower so that interior details may be examined.

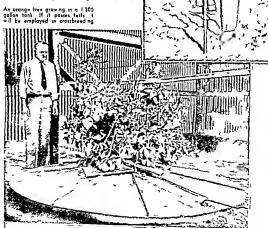


# Protect Our Grops



JORE than sixty scientists attached to the University of California's Citrus Experiment Station at Piverside are con centrating on a battle against the diseases that threaten countless acres of citrus groves and deciduous fruit and date or chards of the southwestern United States Were it not for their activity in tracking down mysterious plant infestations devising preventives and cures through ceaseless laboratory experimentation and developing disease resisting varieties the nation a sup ply of oranges lemons dates and other fruits might be seriously curtailed and the less to fruit growers would run into millions of dollars in a short time

> Gas pumped into the ground with this hypodermic prevents spread of fungus to date trees



# Scientists Run Mouse-Trap Line

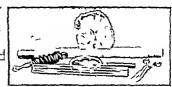


106

other things rodent duseases some of which are suspected of being related to human ills On the circular trapping zera, 100 traps are set at all times each being covered with a weatherproof box and placed in a hole that cuts into an inderground mouse runway Each day a member of the museum staff visits the scene removes the catch and resets the traps Figured on the fifty year basis that means that more than 15 000 visits will be made to the trap line

### Rubber Film Preserves Specimens for Medical Demonstrations

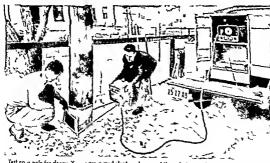
EXCLORED of a transparent rubberized material are being used by a Boston Mass neurologist for preserving sections of human brain and other medi cal specimens employed in lectures and demonstra tions. After a month a treatment with a preservative specimens are placed in the transparent sacs which are then sealed by heat. In this form the material is handled and transported easily



Sections of human brain wrapped in transparent film. At the right is the

# X Rays Spot Decayed Power-Line Poles

Wooden poles that support electric light wires are now being \ rayed to determine whether they are sound or decayed to the point of requiring replacement. A Detroit, Mich. utility company utilizes a portable ray unit inclosed in a cabinet mounted on a small truck as shown in the photograph The poles are photographed at their bases, just below the level of the ground where decay is most prevalent. Boring in the orthodox method of testing the poles for decay but the \ ray system in recent tests, is said to have proved more accurate and less wasteful



Testing a pole for decay X rays are a med slanting downward through the wood just below ground level

SEPTEMBER 1940

# Mew experim al "

# with RO

ROTECTED against deadly explosions by a wall of sandbags and heavy tim bers two young California In stitute of Technology acientists feed explosive gases under pres sure into the motor of a rocket At the touch of a button a leaping spark ignites the mixture and with a roar a sheet of flame and a cloud of smoke the gases go into action Operating a camera one of the re searchers photographs a battery of instrument dials that reveal such vital facts as the thrust of the motor and the weight and pres sure of the gases surging through pipes from me

But the rocket itself in stead of soaring into the heavens remains rooted



anchored in place and pointed earthward For Fdward S Forman and John W Parsons the California rocket re searchers are mainly interested for the present in studying the action of various fuels for stratesphere stabling rocket ships and the effect of their intense heat on various types of nozzles

This question of rock et motor nozzies is one of the major problems now facing rocket ex perimenters who are constantly devising new

improvements and new methods to take the rocket out of the realm of fantasy and into the field of practical use Booster motors to assist rocket take offs gyroscopes to guide flights along straight paths water cooled nozzies range fluders to record altitudes and speeds automatic parachutes that return the rockets safely to earth—these are some of the devices that are now being tested and brought to per fection by laboratory experiments on a dozen fronts

North of Rossell N M for instance rockets wobbe skyward from a sixty foot tower and then straighten out into a true vertical path soaring up two miles into the air at a speed of more than 700 miles an hour At the top of their light they hang in air a spit second then tumble over and float gently down to earth as their parachules automatically belig out. The gyroscopie mechanism that straightens out the initial take off wabble is a development engineered by Dr Robert H Goddard rocket ploneer Stabilizing vanes attached to the rocket are automatically controlled by the gases of the

#### By ROBERT E. MARTIN



Jank W Farsons pepcing an experimental rocket motor for a test. At the left gases burning at 3000 degrees cent gade shoot out of a liny notale. The general view at the far left shows the sandbagged author laboratory that is used by forsons and his associate Edward S Forman.



exhaust atream moving the rocket back into line when it wanders ten degrees away from a vertical path

But actually how close is rocket science to practical exploration of the strategibers at an attitude of say fifty mules? Studies at the California Institute of Technology lead investigators to believe that with the exhaut velocity of 7000 feet a second of haired by Goddard a rockets powder rockets could now be built capable of rinng 100 000 feet. In fact, under some conditions they believe a gas propelled eight of pound helve a gas propelled eight of pound a nozile at the gas of 12 000 feet a second could rose under power to an allitude of fifty miles and then continue constitute straight up for another 175 miles up for another 175 miles

For more than three decades scientists have sought ways to explore the atmosphere at great heights Today their thoughts are turning to levels where rockets would fly through a vacuum and celestial observations night be made without interference from city lights haze clouds or as mole celles of love a nitrudes. One well known clears of the real strictions for the well known to be possibility of a complete astronomical observation; russed a thousand miles above the earth by one set of rocket motors and manualized at that I level by another

Of more immediate practical application in the proposal that frockes take over the duties of beavy srillery in laying down a concentrated bombardment of an intensity not reached even with dive bombing air places and the listest type of field and rail way guns. Major James R. Randolph of the U.S. Army Ordanne Reterve recently declared that reckets could easily equal the chiral terms of the control of the cont

These long range cannon fire a projectile eight inches in diameter. Instead of firing shots of moderate cal her at long intervals add Major Randolph, a rocket plant could fire the equivalent of twenty four inch shells as fast as degred.

Projectiles env saged by this officer would weigh four tons Thousands of them set off simultaneously or in volleys might lay down in a few minutes a withening barrage that present artillery could equal only over a long period of time

Armor piercing rockets Pandolph further proposed could be carried by submarines while on land the rocket shells could be transported in ordinary motor trucks bear mg no resemblance to artillery weapons now easily identified by enemy planes

### Portable Enlarging Outfit Fits in Traveling Case

So COMPACT it can be carried in a luggage type case only four inches longer than this page a new miniature enlarger permits travel ers to turn any hotel room or tourist camp cot inge into a darkroom for enlarging To set up

the apparatus it is only necessary to tighten two acrews Chemicals formula eards and a developing tank can be carried in the case along with the bittle en larger which is said to do high grade work

Portable enla ge n is ca y ng case (i moles a da kroom of any l place you may be





The capsule and appeal in the film cantainer

# Sensitizing Powder Comes in Handy Capsule Form

STEPING up the speed of either movie or still film from fifty to 100 percent hypersensitizing chemicals in powder form are now offered for sale in capsules. To increase the speed of the film all that is required is to drop one of the capsules in the film container and leave it there he required length of time. The chemicals in the capsule which will keep for years according to the manufacturer act upon the emulsion and increase its sensitivity. There is nothing to spill or come in direct contact with the film

# Combined Film Projector and Viewer

View of the state of the state

TRANSPARENCIES can be either viewed or projected by means of a compact double duty accessory recently placed on the market by a New York manufacturer When the

transparency usily ped into place a movable mirror throws the image on a viewing screen If the user deseres it is to be a rest to see the picture enlarged he simply turns a knob and the mirror swings out of the way permitting a lens to project the magnified picture on a wallor screen for more detailed examination.

# New Accessories for



The color on fluid a made by distable on street of paper in water

### Prints Colored with New Tints Are Ferrotyped

Cotober photographs now can be ferrotyped and given a high gloss through the use of chemical tints which are sold in blotterlike strips and applied with pipe clean ers for brushes. When pieces of the strms are dropped in water they produce the photographs This fluid sets quickly so the print can be soaked in water after the coloring is completed and then ferrotyped

#### Exposure Meter Shows Density of Negatives FOR DETERMINING the relative densi-

ty of color separation negatives a new device makes use of a conven tional photo electric exposure meter The meter is placed on top of the apparatus where it receives light pro sected unward through a negative The denser the negative the less the light reaching the meter A special scale attaches to the regular meter



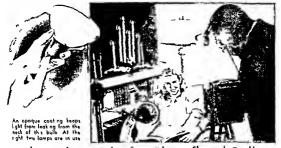
# Compoct Circulor Developing Tonk Parts of the new a reular derelop 112 PHOTOGRAPHY

MORE compact than the conventional rectangular developing tanks for cut films and film packs a new circular product with a spiral groove reel per mits the amateur to de

velop his films with a minimum of chemi cals according to the manufacturer By shding the top section of the synthetic resin reel up or down films ranging all the way from 35 millimeters to 21/2 by 31/2 inches can be accommodated.

POPULAR SCIENCE

# Camera Enthusiasts



# Light-Tight Necks for Photoflood Bulbs

BLACK necks on mushroom type photo food bulbs now prevent stray light from spiling out and shining in the lens of the camera. Such lamps are designed with an interior aluminum reflecting surface which makes the use of a conventional reflector unnecessar. The new opaque coating extending from the base of the lamp to a point beyond the beginning of the reflecting surface makes the neck light tight



### Spotlight on Flash Gun Aids Focusing in Dark

FOCUSIA in reduced daylight or at night is simplified by a small spottight which plugs into the batter; case of an American made flash gun Whenever there is in sufficient outside lighting for using the range finder or the ground glass of the camera for focusing the beam of the little spottight will provide a spot of illumination for the purpose. The lamp can be plugged into the flash gun outlet in a moment. The atlachment also provides a test for the strength of the flash gun battery.

### Socket Adapters Center Midget Flash Bulbs

To CPNIE mudget photofiash hulbs in standard size reflectors incled plated socket adapters are now available. One end of the device screws into the regular socket of a fash gun. The other is slotted to provide a bayonet lock which facilitates rapid reloading. One size of the adapter with a short stem is for small reflectors another size with a longer stem for large ones



Two adapter s zes su t large or small reflectors

# Studio Camera Is Remotely Controlled



With this electrically operated comero a photographer snaps the shut ter from any point

Below a rear yew showing motor that furns the film and shutter speed did

LECTRICITY operates a new studio camera which George M Walters a Califorma photog rapher has perfected after exteen years of research A remote control cable and switch enable the photographer to snay the shutter from any point in the studio. The electrically operated shutter permits L/I 000th of a second snapshot.



### New Extension Adapter Ejects Used Bulbs

BURNED fingers are prevented by a new extension adapter for synchronizers which contains a built in ejector for peanut size flash bulbs. Slight pressure on the ejector forces out the hot used bulb and makes handling unnecessary.



### Enlarging Paper Packed in Perforated Envelope

TO SAVE trouble for the darkroom worker one American manufacturer of enlarging paper is incorporating a perforated strip in the flap of the package. By gripping a tab at the end of the strip and pulling sidewise the user can rip off the perforated section and quickly open the package leaving a narrow flap to protect the contents.



Press ng the ejector forces out the hot used bulb



RAILROAD TIES in the United States are replaced at the annual rate of 100 ries a mile

HYDROCHIORIC ACID is being used in England to esse concrete highways a rough. nonskid surface

FALLING through the doors of moung automobiles kills an average of 300 per sons a year in the United States

AMERICAN bombing plane engines cost approximately ten dollars a horsepower



AUTOMORILE TRAFFIC in Times Square, Neu York City, averages six miles an hour, fire miles an hour slower than the average theed of horse and huggy days

tid alood tills are manufactured in the buman body at the rate of 30,000 a second

MOUNTAIN TOP LICHENS It is estimated. lire for 1,000 years

PRUNE PIT Oil has been found to be ex ceptionally rich in sitamin A



KENTUCKY LEGISLATORS once passed a lau to the effect that Robert Fulton did not m

EVERY SECOND of the year, an average of about 16,000,000 tons of rain and snow fall on the surface of the earth.

NOVA SCOTIAS coast line is three times as long as the entere Pacific coast line of

KANGAROO TAILS provide fibers which are used for thread in certain types of surgery





### Spade with Two Handles Symbolizes Friendship

Twi handles on a Y shaped spade recently enabled American and Canadian officials to symbolize friendship while breaking ground for a new Niagara Falls bridge

### Ancient Sun-Spot Cycles Wrote Record on Clay

PREHISTORIC sun spots left their record on the clay bottom of a western river, scientists recently discovered Just as the growth rings of trees show that every eleven years a season of extra rain results from sun-spot activity so the clay deposits are thicker at similar intervals



show thicker layers caused by unusual rains

sent the steamboat

the United States

# PORULAR SCIENCE Question BEE

We ve added a title variety to our quit for your entertainment. Try to pick the right answer to complete the first five sentences. Then follow instructions for the rest. Answers are an page 223



- I You would be safest from lightning (a) in swimming (b) standing beneath a tail, isolated tree (c) under your bed (d) with in a steel framed office building
- 2 A diamond back terrapin is (a) a highly venomous snake (b) a piece of expensive jewelry (c) a turtle prized as a table delica c) (d) an issue of paper money guaranteed by Treasury deposits of diamonds.
- 3 If one of your cars cylinders fails to fire the trouble may be a faulty (a) spark plug (b) flywheel (c) transmission (d) odometer
- 4 To save weight in building ships and other steel structures inveing sometimes is replaced by (a) pickling (b) n elding (c) vul caning (d) electropisting
- 5 A half hitch is a kind of (a) swimming stroke (b) auto-trailer coupling (c) knot (d) belt for a repair man who climbs tele phone poles

#### Answer "Yes" or "No"

If you oren't sure try for a good quess

6 Are bats blind?

- 7 Do U S. battleships fire torpedoes?
- 8 Should a hack saw be used to cut metal?
- 9 Is a spider an insect?

10 Can the pilot of a motorless glider ever soar higher than his point of take-off?

#### Consored Sentences

Each dash stands for a letter in the

- 12 A carpenter smooths wood with a
  three points determine a
  an aviator
- 13 You would need a — to change a tire a deck of playing cards contains four s a — is a kind of flag telephone switch board connections are made with — s
- 14 A carrot is an edible two is the square of four money has been called the of all evil,

#### Pairing Them Off

Can you supply the missing word commonly associated with the other? Dashes typresent letters

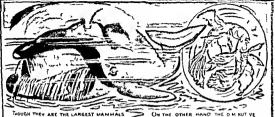
- 16 Flora and ----
- 17 Block and ----
- 18 Latitude and -----
- 19 Stress and ----

#### Now YOU Ask US One!

We pay \$1 for each question accepted. Address the Question Bee Editor Popular Science Monthly 353 Fourth Avenue New York City

# Un-Natural History Gus Mager



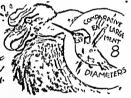


THOUGH THEY ARE THE LARGEST MAMMALS IN THE WORLD WHALES ARE IN GENERAL THE MOST PEACEFUL CREATURES THAT SHABT THE SEA

ON THE OTHER HAND THE DM HUT VE SIAMESE FIGHTING FISH S A NATURAL BORN KILER THE MALES ATTACKING EACH OTHER SAVAGELY!



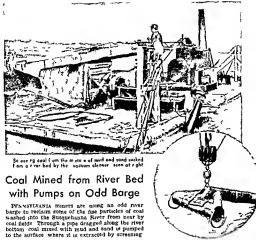
THAT B RO G ANT THE CONDOR S A COWARDLY CARR ON FEEDER BUT THE PYGMY HUMMING BIRD S A FEARLESS PUGNAC OUS SCRAPPER



HHEN FR GHTENED THE HOGNOSE SNAKE PUFFS H MSELF UP TO LOOK LIKE A BIG DANGEROUS REPT LE IF THIS BLUFF DOESN'T WORK HE ROLLS OVER AND PLAYS DEAD! WHAT A FAKE



ALL FISH ARE DUMB PRACTICALLY DEAF AND HAVE DALY THE CRUDEST SENSE OF SMELL! THOUSH THEY POSSESS A FELL DEVELOPED NERVOUS SYSTEM THEY ARE ALMOST INSENSIBLE TO PAIN !





Tuning the tables brings a new batch of wo I to the much ne operator

# Tables Turn To Speed Up Production

TO SAVE Valuable time four work tables are mounted corner to corner on a circular track in a Cal fornia aircraft plant When two operators have each routed a table load of sheet metal parts with routing ma chines mounted on swivel arms the tables are turned bringing a new batch of work in front of each operator without loss of time

# Model Rooms Aid in Planning

## Decorations

To assist brides and other prospective home dec orators in planning the furnishing of various rooms before they set off on a buying spree a novel deco rating kit has been intro With scissors and paste floors and walls of in dividual rooms may be built to scale out of heavy paper Then various cut out forms representing furniture may be spotted about the model room to help the decorator decide what to buy and where to place it. Shopping lists and full directions are included in the kit

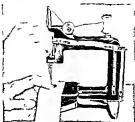


# Chemically Treated Pads Keep Dogs' Coats Clean

COTTON pads saturated with a special lotion make it easy to clean dust and dirt from a dog s hair to keep the animal s coat in first class shape between haths Eight inches square and packed eight to a jar the pale blue pads contain a disinfectant as well as a cleaning agent. The pads which may also be used to swab and clean cats fur are said to be harmless to even the most sensitive skin They are specially recom mended for the care of city pets

#### **Button-Sewing Machine** Does the Job Quickly BUTTONS can be sewed in place within a

few seconds with a novel machine invented by Harry A Landis of Red Lion Pa As shown in the photograph below the button is neld with the first two fingers of the left hand while the thumb and forefinger of the right hand pump a needle bar up and down The vertical needle bar automatically moves horizontally so that the needle will enter the eyes of the hutton in order A small clamp accessory furnished with the machine holds small buttons snaps and hooks and eyes that would be difficult to hold by hand



Needle bar s worked by hand

# New Conveniences



VEGETABLE CUTTER Potatoes and other weg etables are cut for various zers and shapes by this accessory as a lever farces them against interchangeable cutting blades set in a ther end

#### WEATHER FORECASTER

Changes a the weather are forested by the aranmental be ameter at the right it cans the of a pear shaped glass glabe with a graduated mer tube. The water level in the tube reflects changes a the atmosphe to pressure



Two twisted metal wree re place cord in the clothes he below No clothesp in one used as garments are groped between the wres which are separated for the purpose by slding a pulley along the line Rustrood the wree will not stretch





#### VACUUM JUG HAS FAUCET

A pressure created by squeezing a rubber bulb on the vacuum jug below forces I guid from a spout



#### PICTURE FRAME VASE

Patures of fresh flowers are made with the hovel voses shown mounted an ell pical fames One kind hongs on the wall and the other can be set on a table



# for the Household



WALL CLOTHES TREE Fastened to a closet wall or

door this hondy rock has off the advantages of a stand ng clothes t ee Its top ro totes for mo e conven ence

TWO WAY SHAKER D v ded nto two sect ons a new toble accessary dis penses e ther solt or pep per Press ng a lever as shown below shuts off the salt and releases pepper





TRANSPARENT CAP Mode for o forepe ent rubbe product a novel cap parects the hards for water n the shower it can also be u ed as a dust cap and for outdoo sports



A wak sha boad bed de table and stepladde a e n new camb not on unt When it i used as a tha as seen above the oning boad be comes the back rest



BRIDGE TABLE SLING The poblem of BRIDGE (ABLE SLIP) The poblem of stong the bridge toble between potes a solved by the sing shown below. Mode out of heavy den mit has packets in which coiners of the table fit for hanging up in a closet





This port with a eagood home while its owns is owny

## Plants Are Boarded at Hothouse Hotel

A BOARDING HOUSE for house plants is now in operation in the suburbs of New York C by so that householders planning to be away from home on business or vacution trips can leave their plants in safe hands. The plant in raser lands to the plant in reservants from twenty five cents a month for a grant to ten dollars a month for a large tub-planted orange tree. All rathes are

## Milk Is Kept Fresh by Novel Process

PESSANIA milk in hot weather without ice or refr grantion is said to be made possible by a new process. Gases are first removed from the fluid and replaced with oxygen Then the milk is amothered with oxygen for several hours under pressure at from 104 to 176 de grees F Saturated with oxygen is tong it is said to keep for the vicing it is said to keep for the vicinity and the vicinity of vicinity

# Model Homes Built with Ready-Made Kits



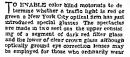
# Horse-Meat "Worms Fool Frogs



TRICKING frogs into eating horse meat by making them think it alive is the so lution worked out by H L Parker of El Monte Calif for the problem of diet in do mestic builtrog breeding. For twenty years Parker has been experimenting in raising frogs as a food delicacy. Recently he decided to try feeding his frogs on a horse meat menu since he found it practically impossible to provide the frogs natural five diet of vast quantities of minnows insects and earthworms. He contracted with the owner of a near by this farm for a supply of

the size of worms and tossed into his concrete frog tanks Eddies of water created by a high pressure water jet from a pipe animated the meat strips and made them appear to swim about on the surface Frogs came hopping from all di rections and snapped up the morsels with relish Now Parker buys his own horses and has them butchered at a near by processing plant to provide food for his amphibian live stock Horse meat is fed to the frogs twice a week and they thrive on it so well that Parker figures in seven months he can make about \$400 profit on an original \$100 invest ment with a batch of 1000 meat eating frogs raised for the market

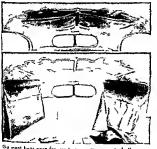
# Glasses Let Color-Blind See Red Light





Though the special glasses a colorblad diver sees light in the taffa standard only when the red or amber a gnal a shin ag

glasses when driving With the spectacles on the color blind driver blook through the red filter section of the lenses as he approaches a tratile light I he sees any light at all in the traffic standard he knows that at must be either red or amber the stop or caution signal since the filter blocks out all rays emanating from the green go-ahead light while admitting the others Sunce eye specialists estimate that one person in every twenty five is color blind the filter glasses should make an important contribution to the problem of in creasing traffic agiety.



Ga ment bags open for aserting or removing suits. In the eppe picture, they are strapped to the roof of the car for troveling

# Car Travel Bags Strapped to Roof Out of the Way

GARMENT BAGS that fit out of the way flush against the celling of an automobile are a new convenience for tourists and travelers A wire frame work fits snugly to the ce ling of the car extending across from the top of one side war dow to the other Two detach able garment bags made of imitation leather and fitted with hangers are suspended by a handle from each side of the wire frame When packed the bags are swung up into an over lapping postion on the ceiling and held in place by straps and hooks as shown in the upper photograph at the left

# Lubricator Feeds Grease Automatically

AUTOMATIC lubrication of springs, control arms, drag links, and other automobile bearing surfaces is accomplished by an ingenious fitting The simple unit is a small steel sphere, having a grease-gun fitting and designed for insertion into bearing holes directly, or in directly through adapters A bollow synthetic rubber ball fills the Interior until grease or oll forced into the sphere collapses the ball and compresses the air

within it This compressed air tends to return the ball to its original round shape, a gradual process that pushes grease or oil into the bearing surface as the supply is used up Each sphere holds a quarter of a fluid ounce



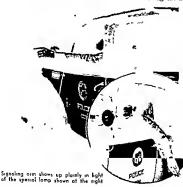


Pumping grease into fubricator A rubber ball, seen of left exponds ta feed it gradually to bearing surface



# Blackjack Shifts Gears

MADE of soft rubber with a leadinghted hall at one end the gearshit knob and shaft pictured at the left can be removed quickly for use as a weapon in case of a boldup or other emergency along the highway



# New Safety Light Makes Arm Signal Visible at Night

To ILLLMINATE the arm of an automobile driver at night, as be extends it to signal a turn or stop, a Los Angeles,

Calif , firm has fust introduced a special safety light. Designed to fit within a car at the back of the drivers window, the safety light can be installed in any make of car within a fen minutes. The accessory has been endorsed by the Los Angeles Police Department, which bas installed a number of the lights in its radio-equipped pa trol cars



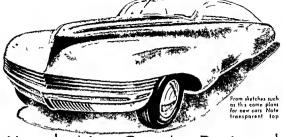
TRIKING directly through the Al legheny Mountains instead of over them, a new 160-mile superhigh way between Pittsburgh and Harrisburg Pa., will be opened for the first time this summer Following the road bed of an abandoned railway the super highway leads through seven miles of tunnels, mostly dug by the radroad huilders. Workers wearing spec al rubber-cushioned helmets, upon which a ten pound rock could fall from a twen ty five-foot height without causing in jury completed the tunneling. The bor ings help to keep all grades at a maxi mum of three percent, permitting high speed car and truck traffic over four concrete lanes. A motorist's dream, the highway has no cross streets, railroad cross ngs, towns, or traffic 1 gbts. Its construction reduces the total vertical climb in crossing the Alleghenies from 10 000 to less than 4 000 feet, materially reducing driving time fuel consumption, and danger in winter on icy grades, while greatly increasing dring ease and comfort for motorists. Its route, with relation to the present Lincoln Highway is shown in the map below

A sect on of the high speed all weathe and from the Susquehanna te the Oho it has no grade leve crossings

A glance at the map be low shows how all steep g ades a e aroided by the u e of an abandaned ro lway bed and tunnels

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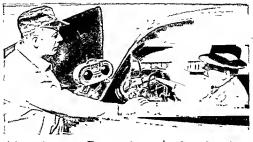


# How the New Cars Are Designed

AN ARTIST sketches an exotic streamline design on a giant blackboard Sculptors model it full size in clay Artisans carre it out of solid ebunks of wood Metalworkers fashion it in sheets of steel Finally a car of new and daring design is created only to be driven virtually to destruction in brutal tests that will decide whether it shall be

scrapped or become the newest product of a mass production line In the accompanying photographs taken in the art department of the Chrysler Copporation in Detroit, Mich you see a few tentative models of the company future cars. There as in similar departments of other manufacture res the endless process of improving the appearance and performance of cars goes on behind locked doors to make your car of two or ake years hence a reality





# New Battery Tester Speeds Car Service

QUICK checking of the condition of car batteries without removing them from the car is possible with a new accessory for service station attendants Cables attached to the unit are readily clipped to one battery terminal and the cars ground As a motorist touches his starter button, visual indicators register the battery's condition



#### Rattleproof Coat Hooks for Auto Windows

WINDOW HOOKS for car doors that do not interfere with opening or closing the windows have just been put on the market Coat hangers, coats, and other articles hung on them are held securely in place Because the hooks are amply covered by rubber, there is no danger of their injuring the window glass under normal vibrations, according to the manufacturer In addition, they are effectively prevented from rattling



Sealed-Beam Conversion Kits Sealed beam lights can now be installed on cars a year or more old with the parts contained in a new headlight conversion kit. The change over is said to be extremely simple It merely is necessary to remove the rim, lens,

and reflector from your present headiamp the new parts contained in the kit, make several wiring connections, and replace the headlamp rim Adjustments are provided for aiming the lamps properly Two types of kits are available, adapt-

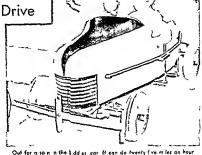
able to most standard makes of cars and trucks.

Ports like those s abave and at left fit sealed beam lights to the headlamps of your cor in a few minutes

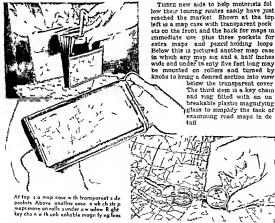
POPULAR SCIENCE

# Car for Children Is Easy To Drive

DESIGNED and built by harl Newhold of Roseville Mich an au tomobile for children has an all steel racing type body mounted on a sixty four inch wheel The diminutive car is powered by a 21 horsepower gasoline en gine that drives the midget at a top speed of twenty five miles an S mplified con trols consist of a steer ing wheel and a com bination lever that op erates not only the starter but the brakes and clutch as well



# Three Map-Reading Aids for Tourists





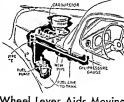
# Reflector Button Inside Door

Protects Motorist

FOR car repairs beside the road at night, it is a good safety measure to have a red reflector button fastened permanently on the inside of the left front door, or of either left door hinged at its front edge as indicated in the accompanying sketch. If your doors are hinged at their rear edges have a button on hand that can be hung on a door handle when needed Motorists coming from behind when the door is open will see the reflector and be warned in time to give you end your car a wide berth,-R. H. P.

# Easily Made Gauge Tells Fuel-Pump Condition

A GASOLINE PRESSURE gauge to show that your fuel pump is working can be made from a length of copper tubing, a pipe T, and an old low pressure oil gauge The T is inserted in the line between the pump and the carburetor, and a new line run to the gauge mounted on the dash. For rubber mounted engines insert a flexible pipe to absorb vibration -- R. McC





#### Wheel Lever Aids Moving of Cars in Garage Two long bolts inserted in a four foot

length of two-by-four as shown at the left and hooked over at their ends provide a highly useful wheel lever for moving cars about in a garage In use the hooks are inserted in the spokes or slots of a rear wheel, and the handle pushed in the direction it is desired to move the car One man can thus move a car easily Rubber tubing pushed over the bolts will prevent marring the wheel finish.—E H.

# AMATEUR MECHANICS



# Long Magnet Recovers Dropped Parts

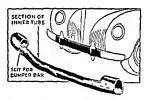
MANY mechanischave had the time wasting experience of loving a key washer or nut in a transmission box or other out of the way place in a car A long reach magnet will get then out in a hurry I make one from an oit Model T magneto mag net around which I

shape I a length of 5 If iron rod as shown leaving parallel extensions about a foot long and an inch apart. The asvembly shoul! be seasone! for about twenty four hours before attempting to use it to become thoroughly magnetize! —P 9

# Mova common clather process of the same to the same to process of the same to the same to

# Clothespin Starts Siphon

You can use a clotherpin to start alphoning gandline from a car tank avoiding the druger of sucking poisonous chemicals into your mouth Pinch one end of a rubber tube between the jaws of the pin and wrap the tube tightly over the whole pin Piace the other en! in the liquid and unwind the tuber R will quickly fill with gas -L. W



The pattern will make a guard for most car bumpers

## Rubber Bumper Protector Is Old Inner Tube

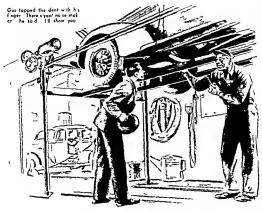
BY CITTING a length of old inner tube in the manner shown in the litustration at the light you can make an effective bumper protector for your car. Folded and stored under or beside the spare wheel in your luggage trunk it will always be available for slipping on the bumper when you are called on to push a friend's car with your own. You will and that it will protect the finish of both your bumper and his from usty meratches—E. H.



Greas ng the surface to keep pa nt from chipping off

# Grease Saves Fender Finish

WHENEVER I have to straighten out a banged up fen fer that is not too badly mashed particularly where the finish has not been chipped when the damage was done I smear heavy cup frease on the outside of the fender. Then I go to work an I hammer the fender Then I go to work an I hammer the state of the st



# Gus Listens, Then Looks

HE tan colored roadster on the Model Garage's greasing rack was five years old and it wasn't of an expensive make

but Gus Wilson nodded satisfaction when he looked at it. Then he turned to the hrisk looking young man who had brought

the job in.

That's the way I like to see a car kept, he observed. Shows that its owner has had sense enough to learn something about the machine he's driving and that he isn't arraid of getting a little oil and prease on his hands. Without even stepping on the machine that the sense of the

The young man laughed bitterly You d win on the gas end of your bet, he said, hut youd lose on the noise end. That engine does make a noise—a queer sort of noise that I ve spent a lot of hours and quite a few dollars trying to kull. But I ve never been able to even locate it let alone kill it. Its annoying but it doesn't affect the car's performance

That so? Gus said immediately inter

ested. How come? I bought the bus when it was three years old, and had about thirty thousand on its clock. I had new piston rings installed spent several evenings getting everything else in first class condition and then started off on a two week vacation trip. The first hundred miles or so were swell-no trouble at all. Then I began to hear that noise-a light tapping. It sounded to me like a valve stem chattering in its guide or maybe a broken ring I got out and looked things over as thoroughly as I could on the road but didn't find anything wrong So I went on. So did the noise! But the car con tinued to run all right,

That evening I checked things more thoroughly but I couldn't find a thing wrong Next morning it was the same as it had been the day be fore-not a sound for a couple of hours and then that tapping again It was like that every day for two weeks and it darned near ruined my vacation As soon as I got home

I had the car gone over by the people who had installed the new rings They said that the noise was caused by the push rods which were worn and should he replaced

So I had them put in new push rods Same thing all over again-Id start out all right but after Id heen driv

ing a couple of hours the tapping would start Since then I've had the car in a dozen shops but no one has been able to find the cause of that noise Now Ive given up looking for it. But at that it still bothers

me Sure-it would Gus sympathized You never hear it until you've heen driving a couple of hours hey? That looks as if-

He broke off went over to the car walked under the greasing rack and ran a forc finger over a small dent in the lower fly wheel cover That's heen there ever since hefore I hought the hus the owner told The first fellow who had her must have dented it driving in a deep rut-or

maybe a heavy rock hit the cover Gus nodded. That noise you were telling me about he said Is it any louder when you're doing fifty than it is when you're going about thirty?

Not much louder the young man said But the taps seem to he a lot faster when Im going fast At fifty the noise sounds continuous

Gus tapped the dent with his finger There s your noise maker he said show you Hey Harry get that lower flynheet cover off will you?

Yhs helper took the cover off Gus examined its inside surface carefully Then he pointed to a small burr on which the metal was polished hright by friction There it is he said A tooth

on the flywheel starter ring that s may be only a couple of thousandths of an inch higher than the others just harely touches that hurr on every revolution of the wheel I suspected something like that when you told me that the taps are closer together when you are go ing fast than they are when you are going slow. A noise like that

When It Comes to Curing Car Ills You Can Sove Your Hands by Using Your Eors and Eyes By MARTIN BUNN

it gets magnified and by the time it gets out to you it might be coming from anywhere in the engine Want me to fix it? Flattening out the burr and putting a little weld in the cover will do the trick

aluays is hard to locate-

There s something I dont understand young man hesitated Why is it that I never hear the noise until I've

driven a hundred miles or 507 Gus told him That hurr

Fapansion isn t high enough for that high tooth to hit it white the engine is fairly cool But after a couple of hours of driving the engine gets good and hot. That causes the metal of the flywheel to expand-and that makes the high tooth hit the hurr

The roadsters owner still looked doubt-I know-you've been stuck before on this fob Gus said This time you needn t take a chance If you ever hear that noise again drive in here and Ill give you back your money

Go ahead and fix it the young man

An hour later tousie headed young Tim Sheridan his dog Dodger on the seat beside him drove into the shop in a sedan of 32 vintage and disreputable appearance

What the heck are you up to non? Gus greeted his favorite disciple

Tim a gray eyes sparkied from behind bis big round speciales. Trying to make a few honest dollars he said. I bought this old wreck for fifty, and I've dug up a guy who il give me a hundred for it-if I can make it run right. That fifty-dollar profit is exactly how much more I need to get rie through my first year at Tech

That close? Good for you! There was appreciation in Guas voice. He knows how



hard Tim has worked getting together the stake which will put him on the road to being able to sign ME after his name Well what's the matter with the bus-

senije decay? I don t know what s the matter with it Tim admitted. What was the matter with it was that it was so full of carbon that it knocked whenever it tried to climb a hill I ve scraped the carbon out and ground the valves But now it dies on me whenever I speed up the engine It II keep gning after

a fashion with the choke ail the way out but when I put it in

-dead Carburetor all right? Gus asked Yes I cleaned it

and adjusted it Gas line too How about the valve clearances?

Exactly what the hook calls for Then it may be the

fuel pump Gus sug gested what That s thought. But it isn't

the fuel pump I put in new disphragms Didn t do any good Yes? Gus said Let a have a look

He examined the pump and carburetor Start your engine and let it idle he told The engine idled smoothly enough Gus grunted. Now speed her up Almost at once the accelerated engine

Gus feit the nut where the gas line con nected with the pump to make sure it was What a this? he demanded He held up his hand his thumb and foresinger were covered with some sticky substance Shellac Tim said I put some around

the line nut to make sure it wouldn't leak You did hey? Gus grumbled Deftly he dismantled the fuel pump Then be carefully examined the check valve a look at this See? The valve is gummed to its seat Some of your shellar worked back into the valve neat Clean it out thoroughly and put in a new check valve

Tim examined the valve intently right-as usual he admitted. The valve a stuck sort of half way-open enough to let sufficient gas flow through to keep the engine lding but not enough to keep it running when you step on it

It was quitting time and Gua began to wash up Tim perched on the workbench and rolled a cigarette You're a good guy Gus he said I sure do need that fifty dollars and now III get it

Forget it Gus growled Anyhow I like trouble shooting Keeps the old hean in working order Did I ever tell you about the hardest trouble shooting job I ever ran up against" It was four or five years ago An ice cream company down in the city bought a fleet of sedan delivery cars and outfitted them with dry ice refrigerators iong they began to find the cars transmis sinns dry when they inspected them and the grease in the differential housing in

stead of where it helonged The manufac turers service man told them to pack the rear hearing lock ring slots with ground cork -but that didnt do any good and neither did anything else that

> charge of their garage ia an old pal of mine and when his boas be gan giving him real hell he called me up and asked me to go down and see if I could find the trouble

headlights are too bright nowo they tried days. That's as foolish as saying The fellow who has modern gas is too strong cars too fast roads too good Remember this. They se all just as sofe or

> They were having exactly the same grief with all their cars so I worked on only one of them I took its transmission down and checked every part -OK. I checked the alignment with the rear end-OK I did everything I could think of and every night the car came in with its transmission almost dry and the grease in the differential housing

> I began to lose sleep over the job-and I hate to lose sleep One day I got down to their garage just as the car I had been working on was driven in I got under it and as I took out the plug to check the grease I heard a peculiar sort of hissing sound That was the tip off Without say ing anything to anyone I took a small electric hand drill and drilled a very small hole us the torque tube

I was waiting when the car came in the next day and I got under it in a hurry The grease was ail in the transmission where it belonged and I knew I had the trouble ficked

All right Tim said Ill hite What was the trouble?

Gus grinned The ring and pinion gears created a suction which pulled the grease down the torque tube into the differential he explained The hoje I drilled killed the suction In the next year a model the makers vented all their torque tubes. One of those little things easy to fix, but the hardest trouble shooting job I ve ever been

GUS SAYS.

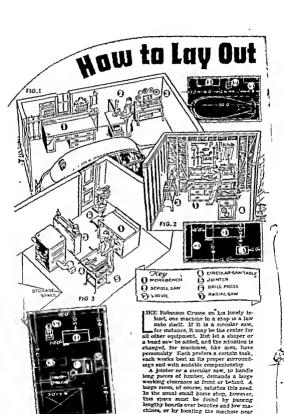
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dangarous as the car drivers that

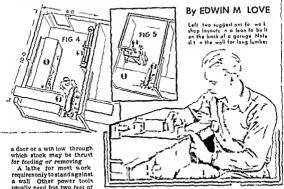
use them!



**BOOMERANGS · PAINTING** 



# Your Home Workshop



The best way to plan your shap is to make rough models of the ma ch nes and move them about an a scaled layout of the floor space

usually need but two feet of

space in front and at the sides It is evident there fore that the placing of a machine depends not only on accessibility

but also on the size and shape of the room the other machines and the type of work to be done

The personality of the user also must be considered. The most convenient placing of equipment is often not the neatest and if the owner is bothered by a tack of order and is oppressed by the feeling of restriction occasioned by irregular spotting of ma chines he may find it best to arrange them according to appearance rather than their most efficient use

This article suggests several arrange ments for small shops equipped with from two to four individually driven woodwork ing machines. There is also a diagram of a fully equipped shop such as a home work shop club might own It must be empha sized that these are only suggestions in tended to help in placing accessories to the best advantage in the room the owner has available Later articles will deal not only with the groupings of several machines but also the use of line shafts gasoline engine drives and special model making layouts

These diggrams show no cab nets. Shouldn't they be considered in a shop plan?

It is the writer a conviction as a result of much experience that most accessories and hardware materials can be stored in cabi nets under the machines and benches and hand tools and lumber placed in racks on the wall or in hanging cupboards Floor space is precious so why build skeleton benches and mount machines on open stands and then build floor cabinets to clutter up the room? Arrange the machines first and ndapt storage space to them Cabinets and similar equipment will be fully considered in later articles

Could a shop be started in a single garage?

If the garage is 12 by 20 as many are it is possible to obtain a working space about 5 wide by driving the car close to one side This is rather narrow and limits the number and kind of machines that can be chosen but it is much better than nothing

Considering everything the layout sug gested in Fig 1 is quite satisfactory The bench indicated is 6 long with cuppoard room inside and a good working space at the vise end With the scroll saw adjusted for cutting from the side not only can small lumber be handled but long decorative bands or cut outs as well

The lathe is chosen because turning can not be done by hand or even imitated with out prohibitive labor If outboard turning is to be done the machine is easily swiveled to a diagonal position

How can end space in the garage be ut lized?

Figure 2 is a good plan for a shop at the end of the garage If a side door is present or can be cut in set the circular saw near it where long heards can be fed in The saw if equipped with rollers can be pushed back at the end of the bench if the car encreaches In this shop moldings on straight work and outs de curves are possible but sawed curves and fretwork must be done by hand

Must benches and machines other than the circular saw be placed against the walls?

No Some of the best arrangements come from putting the ends to the wall or even

by standing equipment entirely out in the room as in Fig 3 This plan is excellent for irregular layouts as in a basement Notice that the drill press lathe and circular saw are within a radius of about 3 from the bench vise A scroll saw could stand along the back of the bench within the same circle All machines are within a couple of steps from the bench

How may a small lean to ar other addition ta a garage be made into a shop?

The plans in Figs 1 and 2 would fit Fig ure 4 is an ingenious arrangement for an ad dition built on the end of a garage 10 wide Although the room is but 6 wide long boards can be crosscut or rapped by the use of a circular saw of the overhead track va riety mounted on a bench at one end A slit in the garage end and a large window opposite will allow stock up to 4 wide to pass A supporting bench is built in the garage

In Fig 5 the bench and lathe ere re placed with a scroll saw the saw bench serving as a workbench and cabinet Machine crosscutting and ripping jointing shaping disk sanding granding ecroil sawing edge

filing die filing and metal eawing are pos sible in this shop Should the first machines be arranged in the arder they would take in a com piete shop? Not necessarily It in better to stand them where they will work to the best advantage As more units are added the work of cer tain machines may become more specialized and they will be less frequently Saw and jainte cambinata near a windaw lothe sout of way but ava lable for most wa scroll sow is by second window A three nine plan Langer boads can be passed over scall saw table by rasing by roses blade gu de Other end at lumbe extends aver a lathe

used so it may be better to shift them to a less desirable position Nevertheless the ar rangement of the complete shop should be planned at the start so that windows doors and electrical outlets can be intelligently placed for that purpose Minor deviations in the original plan can always he made if necessary

LAYOUT FOR

FULLY FOUIPPED

POWER-TOOL

What about the arrangement of a commer cial shop or one for a home workshop club?

Always arrange the machines to save as many steps as possible. In the mass production of an article the machines needed should be close together. Step saving is clearly shown in the discram on this page.

Another point to keep in mind is that if several men are working at once the power tools should be so arranged that the oper-

do not get in one anothers w

When planning a well equipped shop such as far a home we skipped by a range the layout an advance as a gude for a planning such as the state of the

In the arrangement band saw s by window lathe can be used at front or end and shaper can handle for fy long stock. A good grouping to follow when the space is restricted.

At left handy layout for a small shop having workbench and two power tools. Note economy of steps. Window's not needed next to much nes



## Flectric Iron Smooths Sandina Disks

STICK adhesive applied to sanding disks is likely to produce an uneven coat especially if the metal is cold After putting the sand paper disk in place cover it with a sheet of wrapping paper and press it with a fairly warm electric flatiron. The disk will adhere quickly and all lumps of adhesive will be leveled off -- LESLIE KINNING



The dist of sandpaper is covered with wrapping poper and pressed with a fairly warm electric man

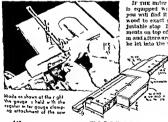
## Two-Ply Bosebaard Bends to Fit Curved Woll

BENDING baseboards to fit curved walls can be done readily if two or more thin layers are used as illustrated above Apply them to the wall separately Fasten the in ner layer or layers with screwa and the outer one with finishing nails. If the bend is sbarp enough to require it screws can also be used at the bottom of the outer layer where they will be concealed by the floor molding - John Modroch

#### Using Blowtorch Near Woodwork

WHEN it is necessary to use a blowtorch on plumbing near beams flooring or other woodwork a quantity of wet powdered as bestos may be placed on the area where the fisme might reach to prevent a fire hazard

## Adjustable Cut-Off Gauge Added to Circular Saw



IF THE mater gauge of your circular saw is equipped with a clamping attachment. you will find it easy to cut small pieces of wood to exact size with the aid of this ad justable stop In the original the measure ments on top of the body piece were scribed m and afterward inked but a short rule may be let into the wood and will serve as well

Dimensions of the original attachment are given at the left.

In use the jig is slipped under two of the clamping screws and the right edge of the body section is brought just up to the saw teeth and clamped The bliding stop block is then set at any point desired and clamped G H S

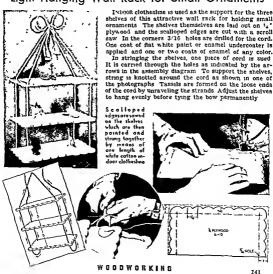
## Planing Vise Adjusts Itself to Any Wood

For planing the edges of different thicknesses of vood, ranging from very thin to 2°, have for years used the quick acting rose shown at the right. It can be made small for model work or larger for general work One great advantage is that it does not obstruct the surface of the workbench as is the case with the V-type planing stop so often used A powerful spring is required. The one on my vise was taken from an Gd iron bed —ABBOTT B DAYD.

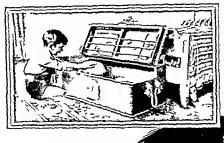
In Laying out accurate measurements on wood it is best to make the marks with a knife or a rather hard sharply pointed pencil. If the rule is old and worn measure from the 1" mark rather than the very end



# Light Hanging Wall Rack for Small Ornaments







The chest holds a lot of toys and there is a rack in the cover for story and painting books. The lid is uphalstered in the simple way shown below

then made to fit on the upper edge of this how at the rear. It was doweled and glued in place and a 1-" board 514 by 3034 was glued over this

In making the cover frame notice that the front plece over laps the two sides and the back fits on the inside. The front is acrewed and dowel pegged to match the chest. A top \_\_ volume\_ volu

The ornamental rail is shaped on the spindle shaper but it could simply be beveled. The back and sides are intered together. Cut the sides to the quarter round shape indicated and assemble with done is

Four handle brackets are cut from % atock and green a moided or beveled edge Bore a %r hote in the center of each for the rope handles Screw the brackets from maide of chest and use gite also They are placed 54% from the edges of the chest front and back and \(^1\) from the top Do not add the rope handles until after staming and finishing the chest.

Maple stain is brushed on the wood and wiped off with a clean cloth Allow this to dry overnight then apply three coats of thin orange shellar. Rub with 3 0 steel wool Add a hand painted boat or a natural de calcomania (transfer) if desired. Then polish the wood with furniture wax

For upholstering a nautical design in chints or cretonne is used The cloth with the finished side down is laid to overlap the back edge of the lid only 1" A piece of any ordinary cloth is laid on top of the up holstery material. Cut a 'h," wide stip of

CLOTH CARDONARY

thm cardboard and tack to the very edge of the lid over the edge of the two fabrics.

A pullow is now sewed up to the width and length of the cover Fill it with mohair and sew the opening. Let the two pieces of cloth dangle over the hack of the 1nd and tack the pillow in place. A strip of cotton is next laid around the two sides and front to pad the sharp edge of the cover. The two rabrics are pulled over the pillow and tacked to overlap the sudes and front 1?

Cut a strp of the uphoistery material It's wide and long enough to go around the three sades of the hd Cut a strip of eard-board 14" wide and fold the cloth around to make a binding Tack this around to cover the tacked edges of the cloth A "s" white cottom marine rope is now mailed over the binding with 1" brass roundhead nails. Large scalloped upholstery tacks are nailed in at each end to cover the ragged end of the rope Do the same at the bottom

# Gun Cabinet

CERTAIN rough and ready simplici ty makea this knotty pine cabinet particularly appropriate for a sportsman's room. It is finished in a rich amber tone and the silhouette of a dog ornaments the upper part of the door The cabinet is 63 high 161, " wide and

10" deep outside measurements Dimen sions of all the pieces are given in the list of materials and the parts have been let tered for ready identification

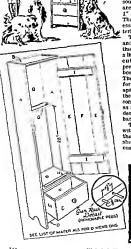
Except for the plywood back the cabinet proper is constructed of dressed white pine The exposed parta are of a grade having sound knots the gun rack and m nor parts are clear stock. The thickness is nominally I" but actually the wood is about %" thick The widths can be changed slightly if nec essary to suit the stock widths of the ma terial available

The rear edges of the sides A and the top and bottom E are rabbeted so that the 1," thick plywood back can be set in The dog s lhouette (either design may be used) is cut from %" thick

pressed composition board and glued on The gun rack C is bored for pegs spaced 11/4" apart It is best to leave these unglued so that some may be removed as necessary when it is desired to store double barreled guns The wood is finished

with amber stain and thin costs of orange shellac rubbed between coats with steel wool





wide and deep Its fo

# of Knotty Pine TOM E. MOORE



# Gauge Simplifies Panel Marking and Saw Jointing

MADE on the circular saw to a few minutes this hardwood gauge is used on a vardstick for marking napels and other large work. It also serves to hold a piece broken from a discarded file of about the same cross section as the yardstick so that the teeth of handsaws can be jointed easily to a straight line Shape the parts as shown in the draw ing below but don't cut the bevel for the wedge slot until after the wedge is made. The slots can be cut on a circular saw Be sure to make the two main parts of the gauge a pair that is right and left hand so that they fit together correctly -R L



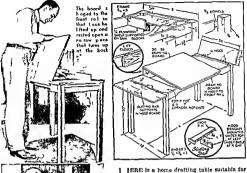




Us ng the hardwaad gauge and an or d na y yardst ck to mark a measure ment on plywood

To joint the teeth of a handsaw fit a pece of a discarded file in the aguae as at lett

# A Drafting Table for Use at Home



a small apartment. When closed up it can be placed in the foyer or hallway and looks like an ordinary flat topped table.

The center section of the top is a standard drawing board purchased in an art supply store. The remainder is constructed from clear white pine. The only bardware required is four pair of brass but hinges 212 long and about 1½ " wide when open Use a ig for lining up the holes in the rails

and legs for the \$\frac{3}{2}\] dows she with which the table is assembled. Before gluing cut the front rail to the shape shown and cut \$\frac{3}{2}\] by \$\frac{1}{2}\] endowed and cut \$\frac{3}{2}\] by \$\frac{1}{2}\] notches in the side rails for the sing bars. Use long bar clamps in gluing the frame and let it dry overnight before removing them. Next mount the drawing board by bligging it to the front rail so that it can be lifted up from the back and rested on another piece of wood that is hinged to the back rail.

Sand the table thoroughly and either apply a staned finish or paint to match other furniture or wood work in the room—A J SODARO

A 1-QT CARDBOARD milk carton that has been washed out makes a good quart measure for use about the shop or home with oil and other hquids. The measure may be thrown away after use—O W L10N

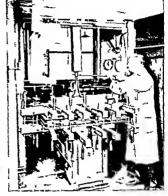


## Stripes of Paint Anchor Stop Nuts on a Drill Press

nerry press ston nuts often loosen and work down the seren n hen the machine is heing used for horing holes of uniform denth This con he presented he applying a strine of varnish or paint length nice of the screw When dra it makes the nuts hind sufficiently to hold one in position long enough to drill two or three holes

This procedure manife the bother of running the lock nut down the screw and often saves considerable time\_I. h



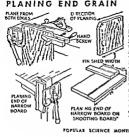


#### lack Acts as Veneer Press

CONFRONTED recently with the problem of recovering a number of hadis worn table tops with linoleum I rigged up a large veneer bress under a good sized brick lintel A house jack and a piece of 4" by 4" stock provided pressure at the center and hand screws were used around the edge.-E. C. H.

#### PLANING END GRAIN

#### I WOODWORKING 1



1 If the board is wide enough to be planed halfway from both edges sunport the free end on the bench too by clamping a hand screw to it as shown
2 If the board is narrow but hever theless wider than the finished width is to be cut off one corner to prevent wood from splitting 3 When the board is narrow and of the finished width clamp another board behind it in the bench vise A shooting board like the one illustrated may also be used in this case Rold the board against the stop and use the plane resting on its side A jack plane smooth plane or block plane can be used on end grain depending upon circumstances but for most small work the block plane is best,

POPULAR SCIENCE MONTHLY SHOP DATA FILE



C. W. WOODSON

PRING collets afford an accurate con venient and speedy means of holding drill rod and other finished bar stock in the lathe as illustrated in Fig 1 They can easily be adapted to a precision lathe by the home pade draw in chuck at tachment shown in the accompanying photo graphs and detail in the drawings at the end of the article. The drawings are exact end of the article ly half the size of the attachment made by the writer for his wn small lathe but the d mensions obvious will have to be adapted

to the lathe with bich the draw in chuck is to be used A collet adapter draw in spingle and spindle cap Fig 2.7 is on the lathe itself draw in spindle and

This particular attachment was designed for a 9" lathe with a 24" hole through the headstock spindle. The collets themselves may be purchased or made

The handwheel in this instance was taken from a discarded valve. It was however given a finished appearance by being ma chined all over and polished bright. It was then bored to fit the boilow draw in bar as in Fig 3

The hollow bar is a piece of cold drawn seamless steel tubing 1332" long with an outside diameter of s," and an inside di ameter of 9/16" This was chucked in the lathe to run dead true and bored and threaded \* -26 threads on the inside to receive the end of the collet. The tube was now placed hetween centers and turned smooth as illustrated in Fig 4. The center section was relieved sightly in this operation to avoid any possibility of its binding in the headstock soundle hole

For the next step it was necessary to fit the handwheel to the tube To clear the gear guard of the lathe the wheel had to be placed in back of a long tollar. The collar was recessed to fit over the hack end of the spondle as shown in the drawings Tha re cess accurately centers the outboard end of the drawbar when in use

The collet adapter shown in Fig 2 is best made from a short has of tool steel Turned to dimensions and finished on the outside as in Fig 6 it was cut off and inserted in the spinidle hole of the lather Here it was drilled and hored as in Fig 7 and then care fully brought to dimensions that is twice the size shown in the drawings Great care was taken in the boring of this part, as the collet must he supported at each end only and have clearance in the center for spring. The accuracy of the whole attachment depends largely on the accuracy of the work

on the collet adapter Every effort should be made to machine it perfectly

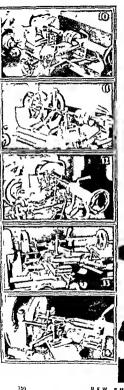
A feather as shown in the drawing is needed to drive the collet and the adapter was drilled as in Fig 5 to receive it. Rivet ing this in place finishes the adapter which is then ready to receive the collets. These may be purchased or made up by the method to be described.

The spindle cap also shown in Fig 2 was made 'o afford protection, to the threaded end of the headstock spindle nose. A short in the piece of cold rolled stell was chucked as had from the Fig 3 bored and threaded the inside dit made as the cold rolled stell was chucked as the first as the first of the small faceplate that comes with the latter when the first of the f

The spring tempered collets are best made from tool steet hard

ened tempered and ground accurately to size A set of eight ranging in size from 1/16 to 1" by six





teenths is desirable (Fig 2) It is well to use a bar of steel slightly larger in diameter than the collet and 1, " longer This makes the blank about 74" by 3" which is chucked as in Fig 10 and centered on both ends

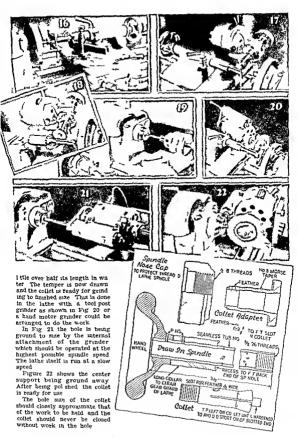
A roughing cut is taken before mounting the stock in the center rest where the large clearance hole is drilled and bored (Fig. 11) The outer end of the hole is beveled 60 deg to receive the tailstock center and the collet is turned to shape as shown in Figs 12 to 15 A slight allowance must be made

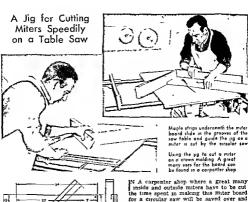
for granding to exact size after bardening The 5-"-26 thread is cut on the end as shown in Fig 16 to fit the threaded hole in the draw in spindle. While still in this position the keyway for the driving feather is milled as in Fig 17 and the three slots are cut (Fig 18) These slots are not cut through the center support left on the collet but should he cut far enough out to clear the hole and far epough back to allow for spring in the collet The metal slitting saw should be thin and of small diameter

The collet can now be mounted in the adapter in place on the lathe spindle as shown in Fig 19 where the hole to receive the work is drilled slightly smaller than fin ished size to allow for grinding after hard coing The finished hole size should now be stamped on the end of the collet and it is ready for hardening and tempering

If an open fire is used for hardening it is pest to place the collet in a metal tube and bring to a low red heat. Then plunge it a



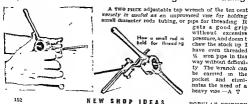




inside and outside miters have to be cut the time spent in making this miter board for a circular saw will be saved over and over again

The board is made of %" plywood with maple cleats at the ends one on top and one below as shown Maple guides are fastened with screws through the top to fit the saw table grooves accurately These should be so placed that the saw cut may be made in the middle of the plywood after the guides are in place by turning the saw up through the plywood Fasten the fences accurately and strongly with screws from the underside after placing glue beneath the mitered ends - CHARLES A KING

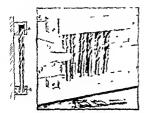
#### Tap Wrench Holds Rods and Tubing for Threading



gets a good grip without excessive pressure, and doesn t chew the stock up I have even threaded 1/2 iron pipe in this way without difficulty The wrench can carried in the pocket and eiminates the need of a heavy vise -A T

#### Wooden Rock Pratects Bits fram Damoge

Fot holding twist drills, auger hits, and other tools which should have their ends protected, a rack may be made of two strips of wood with holes bored as shown below The strips are so spaced that when the upper ned of the tool is pushed into an upper hole, the lower end can be swung in and dropped into a lower hole, yet the tool does not fron down as of act that the upper end is released. To remove the tool, simply litt it up and swing the lower end out.



Rack made of parallel wooden strips having holes aligned vertically. Upper holes must be deeper

## Two Smoll Tapered Parts Turned at One Setting

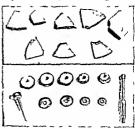
CONSIDERABLE time may be saved when turning several tapered parts for lath fittings handles and the like if two are turned on one piece of stock. Separate the tapers after fitting to the socket. In the case of lathe fittings, insert the tapered shank in the headstock spindle to hold it white Joing any additions machining





#### Workshop Towel Hangs from Rubber Holder

IF A SHOET piece of radiator hose, cut as shown is tacked on the wall of the workshop above the lavatory, it forms a quickacting holder from which the towel may be jerked carelessly without being torn



#### Worn Grinding Wheels Cut into Tiny Ones

TODI-POST granding wheels 1" in diameter and smaller are rather expensive in comparison with wheels from 4" to 6" When, therefore hench grinder wheels of if" to %" face become worn too small to cut for a eacidently broken, it pays to cut them up into small wheels Chalk one side white, draw the desired circle with pencil, and drill the hole with a regular drill, but use water for a colonit Shape the diameter with a bench-grinder wheel, then dress the small wheel as required.

#### Lathe Tailstock Arbor Holds Faceplate or Chuck

AN ARROR of the type shown as a useful lathe accessory for holding a chuck or faceplate in the tail stock it is hander than an ordinary drill pad because when a faceplate is fitted to it metal or wood peces can be attached to serie as a 1g for drill gduplicate pieces. The drill or drill chuck is held in the headstock spandle The

special arbor should be finished in the spindle of the lathe. If the work is carefully executed it should be true to less than 0.001 as to squareness when placed in the tailstock for mounting a chuck or faceplate. ELIMER A HUBBARD

ceplate ELMER A HUBBARD

TO GRIDUATE accurately the side or circumference of a handwheel or s m lar part fit the required lathe thread up given to a suitably made head center fit an indexing screw to a member boiled to the bed of the lathe and scribe with a sharp pointed thread ing bit set in a tool holder and at right angles to the conventional now too. — It is





#### Solder Coiled Compactly

A COVENIENT way to handle wire solder especially when it is necessary to get late tight places is to roll it around a pencil then pull the pencil out and push one and of the wire back through the center as silustrated at the left. Wind the loose end down around the straight end As you use un the solder pull the end out —P R.

#### INK FOR MARKING METALS

[FORMULAS]

Gum arabic 8 grams Copper Sulphate 20 grams
Sal smmon ac 16 Hydrochloric acid concentrated 10 ec
Lampblack 4 Water 20 cc

Soften the gum arabic in the heated water add the acid slowly while stirring then the sal aminomiae next the copper sulphate and finally the lampblack Apply with a fresh steel pen a quill cut from a large feather or a rubber stamp. Before using the link see that the metal is freshly polished and clean it with denatured alcohol and a cloth.

POPULAR SC ENCE MONTHLY SHOP DAYA FILE

#### Brush Presses Inner Tube Against Buffing Wheel

IN SEARCH of a convenient handle for holding inner tubes safely against a buffing wheel preparatory to patching them one mechanic discovered that a discarded painthrush was well adapted to the purpose as illustrated at the right

WHEN soldering the outside of the bottom and sides of milk cans pots pails and the like it helps to place an electric lamp beneath or inside the article Any holes can then be readily seen

#### Old Table-Lamp Standard Utilized as Lathe Light



lamp standard, with base removed was used for this lathe light It was fastened on the back of the carriage with a small bracket This type of illumination is most practical because the light moves with the carriage and therefore is always directed on the tool so the operator can see what is done

-D D FULMER

AN OLD table-



The samer tube is held safely against the buff ag wheel with the aid of the old brush

#### Paper Glued to Thin Shims for Easier Handling

To LAY out and cut shims from very thin brass or steel, first glue a sheet of white paper on the stock When dry the stock is much easier to handle, and the holes and shapes can be marked plainly with a sharp pencil The paper is removed after the shims have been cut by soaking them in water for a few minutes, then peeling It off -CHARLES HOMEWOOD

LUBRICANTS for Brilling, Counterboring, Countersinking	[SHOP	METHODS

MATERIAL BEING	SUITABLE LUBRICANTS							
WORKED	Dry	Milk	Lard off	Parattin	boap misture*	Kerosene	Turpentine	abo3
Aluminum	{	{	1		{	x	x	X
Babbitt	<b>.</b>	į.	1 x (		ţ	}	}	
Brass	l x	1	1 1	x	Į.		, ;	
Bronze	XXX	i	1 1		ì	(	1 1	
Cast iron	) X	1	1 !		1	J	) ]	
Copper	)	į x	) 1		1	3	1 1	
Glass	1	1				I	X	
Hard steel	Ī	)	1 !	•	1	1 x	X .	X
High speed steel	]	}	XXX		J	,	) ' }	-
Lead	1	1	) X		1		1 1	
Machine steel	}	,	X	ł	X	,	, ,	x
Malicable iron Monel metal	ł	ž.	1 :	1	,	1	) :	X
Soft alloys	ł	1	X\$		1	,	<b>!</b> {	
(of aluminum etc)	1	1	!		!	x		
Soft steel	1	i	f		í	( ^	: 1	x
Wrought Iron	1	i	X		X	(	1 (	X

Auer 2 pt off ear 1 er sedim explosers 1 ns bride 1, se bride 1, se bit and both for minutes before units of the pt off early and the sed of the sed of the bride 1 ns bride 1, se bit and both for minutes before units sed of the sed

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# Painting Questions



#### HOW TO REMOVE DRIP STAINS FROM ASSESTOS SHINGLES

My new osbestos shingle side walls have a drip stoin here and there under window sills. I have tried to remove these with gasaline but with no effect. What should I use?

Use one cup of trisodium phosphate powder to a pail of hot water Scrub the stained area thoroughly then rinse with clean water and a sponge

#### WHY OUTSIDE PAINT CHECKS

Lost year we pointed our house blinds and now they are badly checked and alligatored. Did the pointer use too much direr or what is the trouble?

It is possible that too much drier was used but it is much more likely that a hard drying paint was applied over a soft coat in which case alligatoring or checking al ways occurs. The use of prepared paints over lead and oil will cause the same thing Either system however, is good when used throughout.

The only practical method is to strip the blinds in a tank of bothing trisodium phos phate solution using a pound to a gallon and arent them clean with a palmetic fiber foor serubing brush. Hose off with clean water let dry thoroughly sand where he essary and replain with the new nonfading type of outdoor enamel intended for trum and trellines. Two coats will be required

#### WHAT TO USE FOR RUBBING

I notice that you specify the use of FFF pumice stone and crude oil for rubbing variesh. I have always used rottenstone and linseed oil. Which is better?

FFF pursues stone and crude oil or hight golden parafin oil do a better and faster job than does rottenatione. The latter and taster pot than does rottenatione. The latter is too fine and too slow for anything except pol polished as in the past. Lanceed oil should never be used in rubbing as traces let in corners dry to a sticky mass that is hard to remove. The crude oil or parafin oil is easy to remove with a stirt brush and a mixture of one part oil and two parts grachine. Vipe of one part oil and two parts grachine.

#### PAINTING WITHOUT DRIPS

I have been decoroting my living rooms with the new type of water casein wall point. I find this material most satisfactory, but the brush drips bodly, especially on averhead work. How can I stop this?

Master painters frequently give their men. two 6° brushes for this work only one of which is used at a time. One brush is dipped. 14, spatted against the inside face of the pail and then used to brush overhead. This is continued until the brush starts to leak at which time it is wiped across the edge of the pail until clean. It is then bung on the pail with a book and the work is continued with a book and the work is continued with the second prush.

In lieu of a second brush get a child a rub ber ball cut it in haif punch a hole in the crown side and slip tightly over the brush handle with the hollow side facing the bris

#### MSWETED By RALPH G. WARING

tles The cup thus formed will stop leakage if wiped out from time to time

#### REMOVING OLD CALCIMINE

I recently purchased on old New England formhouse, which I wish to remodel for a summer home. The interior walls, while sound, are covered with calcinine are whitewash, but I want to give them an egishell oil point treatment. How should they be prepared?

This work is hest done by two people one of whom uses a paul of warm water containing a cup of vinegar to sponge and wet the surface thoroughly. The second person follows within a few minutes and uses a painett brush and a pal of water containing one cup of trivodium phosphate powder to loosen and wash off all traces of whitewesh. A wide putly knife may prove of value in speeding up the work. Let all surfaces dry with wide-open doors and windows.

Cut out any cracks or dents and repair

#### KEEP BRUSHES OUT OF WATER

Recently I read that many painterskeep brushes sooking in water when not in use, but isn't this very harmful to the bristles?

Whoever wrote that ought to be fined \$50 or given six months in full Suspend occasionally used painthrushes in a mixture of half pure turpentine and half pure run lin seed oil so that the bristles remain straight and hang clear of the bottom of the container by at least 1" Wey such brushes dry before using They will keep in perfect condition Water, on the other hand makes the bristles soft and fashly

#### PAINTING RESINOUS WOOD

Here in the south we have trouble with pine resin streaks showing up an our autude trim. The paint cracks like on alligator's skin and is now peeling off How can I cure this?



Have a reputable painter hurn off the broken-down coats after you have obtained scritten permission from your

fire insurance company to do this work Without this permit you take a chance on having all your fire insurance invalldated

This burning is necessary, first, to remove the old paint, and second to draw, out the excess resin from the wood Sand the trim. Prime with aluminum bronze of the varnish grade, using 2 lb of bronze in 1 gal of outside spar varnish. Wet the bronze to a paste with turpentine hefore adding the varnish. Brush out well dry hard and then give two coats of firstquality paint. Sand the first coat lightly when dry

with patching plaster. Dry hard and cut down with No. ½ abrasive paper until level and smooth. Then proceed to use the eggshell wall paint according to the manufacturers directions.

#### PRESERVING COPPER SCREENS

A previous tenant painted our copper screens black How can I get this aft? We live near the seashore, so what should I da ta keep the copper Irom turning green?

Lay the screen down over a sheet of metal or any building board that has been given a coat of hot paraffin to stop absorption Use a heavy bodied or marine-type varnish remover on the screen wire Apply with a slow, flowing motion in one direction only,



WATER USED FOR FINAL RUB

Why do you use wet cotton wasts for o final rub ofter crude oil and pumice stans?

let stand ten minutes test with the finger to see if the finish is cut down to the wire then scrub loose with an ordinary palmetto brush. The wire must press against the backing material throughout because copper or bronze mesh is too soft to stand un supported pressure

Turn the screen over and repeat the process very carefully to prevent springing the wire Give a final wash with another scrub brush and denatured airohol. Clean up the frames as well. Let dry oversight then give a light brushing from both faces of outside spar variable. Blow out any places where the variable has bridged the meshes. The metal will not be corrooted by sait at

#### PREPARING A PLASTER WALL

We are planning to wall paper several rooms in our new hame, but have been warned that the plaster may be too fresh and that this might couse discoloration or other trouble later on is there any way to test the plaster?

Before well paper la hung on a plaster wall it is important that the plaster be in good condition without bot spots caused by excessive lime If in doubt apply a five-percent solution of phenol phthalein which can be obtained at a drug store. If this chemical causes a stain to appear ranging in color from pank to deep red the plaster requires to be neutralized before any paper can be safely hung. Thus can be done by plasted to a gallon of hot water.

After the wall has dred it must be proper.

erly steed. In case the plaster was found to have an excessive amount of lime or is otherwise in doubtful shape it is best to pre pare a special area as follows eight parts ordinary commercial wall paper size or gibe size one part molasses and one part winegar. Heat airs well and apply to the the part molasses and one part is the part molasses.

#### RICH STAIN FOR MAHOGANY

How can I give a Colonial monogony finish to a table I have made?

Usually this is a deep mahogany color of rich reddsh tinge First stain the wood brown mahogany let dry and rub with 8/0 garnet finishing paper then apply a cost of red mahogany stain Fill the grain with one cost of the proper stain of the red red one cost of the prade four hour floor varnish thanned with an equal amount of turpentine and follow with two or three costs of full body varnish Rub to a semipolish with FFF punities stone and on

#### REMOVING PAINT FROM GLASS

What is the easiest way to remove a pointed sign from a window?

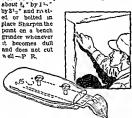
Make up a paste of 1 lb of ordinary whit ing and a small quantity of water contain ing all the washing soda it will dissolve Apply thus paste freely to the painted letters on the window. Leave it on until the letters are quite soft and can be cleaned off with a wad or roll of newspaper.

#### Emergency Work Flag Set Up on Shavel

"WANING" or 'stop' flags are easily carried on construction pols for emergency usef made as shown. Short sections of raduator hose, shi topen at one side, are attached to the crosspucce and tip of the flag. These grid he bandle of a long handled showl which may be stuck into the ground to serve as the supporting staff —G H.

#### Taol for Cleaning Out Cracks in Plaster

BEFORE patching long, narrow cracks in plaster walls such as those that often occur in the corners of a room or along the baseboard, it is necessary to widen them clean them out thoroughly and undercut the edges a little. This can be done quickly and easily with a crack-opening tool made as shown below from an ordinary beer-can opener. The handle is shaped from a soft pine block



A wooden handle is bolted to a beer can opener



The flog is held with Dieces of rod afor hose

#### Removing Stamps Quickly

STAMP collectors can remove stamps almost instantly from envelopes without runing any risk of damaging them by placing several drops of

several drops of water so as to form a little pool over the entire surface of the stamp and then heating the water with an electric burning or pyrographic pen This quickly softens the muchlage, and the stamp comes off



#### Casein-and-Whiting Cement Fastens Small Handles

When a knife, tool, or other small implement must be replaced in its handle, a satisfactory and easily prepared cement enosists for one part each of waterproof casem glue and whiting. The glue gives the compound an address e and waterproof character, while the whiting provides bulk and lessems the tendency to shrink—O B

If You standardize on 12" hack-saw blades of the hand style and make a habit of using the forward 6" until worn, then the remainder of the blade, you will get much longer life out of each blade





To use on electric fan as a kitchen ventilator set a plywoad panel with a hole I larger than the fon digneter between the window trim and a cleat on the shelf A catch holds the ponel at the top



When two doors open ago not each other a small rubber wheel attached to the top carner of one door prevents the knobs from scraping the panels



from drying and cracking after it is applied by adding 1/2 as, costor all to 1 at coment Even after it has dried it may be bent like cellulaid



## HOME SHIPSHAPE



Bulbs in high ceiling fistures can be removed with a suction cup attached to a pale. Wet the cup and then press against the bulb firmly



Powdered graph to obtained from the lead of an ad nary pencil males a good lock lubricant It may be blown in fine ejector's available

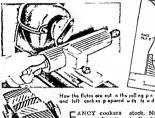


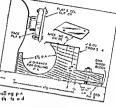
Precous stanes can be cleaned with tooth paste Apply the paste (any papular brand) with an old toothbrush and rinse the stone in running water



To reduce the weight and volume of keys cet off most of the bows of 11 a /s hale and hold together with a small bolt

#### Fluted Pin Rolls Fancy Cookies





are easily pre pared with a fluted rolling pin The one shown le an ordinary rolling

pin 2.1 in diemeter which was futed with a cutter made from a piece of flat steel 3%" by % by 1. The ends were ground to the shape shown and the cutter was mounted on the faceplate of the lathe A fig to hold the rolling pin in position under the cutter was cut from a piece of 2" by 4 stock. Note the sheet metal gu de ettached to the top of the jig One end was bent over so it would fit in a groove already made and assure even spacing

A line was merked elong the pin for the first groove The lathe was started and the pin pulled forward slowly as the cutter ploughed out the groove The other grooves were automatically spaced by the sheet metal guide

For best results in meking cookies a very short dough with little or no leevening should be used —BENJAMIN NIELSEN



#### Clip Keeps Tape from Unwinding

To AFFLY a restricting brake on your tape line and prevent it from unwinding too eeelly and tangling bend a wire paper clip at a right angle and solder it on the side of the reel box II is an easy matter to elip the tape under the clip and hold it at any desired length

#### Foolproof Length Gouge Clamps on Yardstick

For marking lengths or transferring measurements when cutting wood stock I find it easier faster and more accurate to use the shing indicator illustrated IR is a common spring paper clip to which a list a common spring paper clip to which a dicator can be clamped over a yardstike or any thin strip of wood Three or four of the clips may be set along a rule or stick when you wish to record several measurements. Where lands measurements Where lands measurements where lands measurements where tacks the common lands were two shorter sticks the you must telescope two shorter sticks the your lands who shall clamps—RAIFIN C COX.



Arms of Easy Chair Re-Covered with Cloth Taken from Back

With the cover material on the up holstered arms of your favorite armebals has worn through while the rest of the chair remains in good condition you do not necessarily have to go to the expense of re-covering the entire chair Almost always the rear of the chair back is covered with a large panel of the same material and this is enough to re cover both arms.

First a narrow fold is turned to provide a strong finshed edge which is fastened with gnup tacks along the outside under edge of the arm roll. Next turn the piece of cloth up over and down the inside sur face of the arm. Carefully fold and fit is over the front end of the arm and tack down along the rear outside edge of the vertical part of the arm. After the cloth has been pulled down smoothly the lower made edge is stutched to the original covering and the back edge is tucked into the space where the arm meles the chair hack



A piece of cloth of suitable color is after wards tacked on the chair back where the original cloth was removed —H. O BUMANN



#### Short Section of Hose Used as Finger Vise

MANY small flat pieces that have to be shaped or instand by filing can be most conveniently held in the fugers with the aid of a section of air hose or heavy water hose about ½ long. Out a V mito one end of the tubing to fit over the tip of the fore fuger as shown above—F B

#### Keeping Dial Phone in Place

Dial. telephones have an aggravating habit of slipping on a polished deak when habit of slipping on a polished deak when you are dishing thus turning a one finger job into a two banded one. Mine used this until I brushed a little paper cement this until I brushed a little paper cement on the felt on the bottom. Now the phone stands as if bolted to the deak—E C BEON I

#### Nails Stuck to Hammer for Starting

A 6000 trick for starting nails where it is inconvenient to hold them is to rub a little bett dressing on the side of the hammer head. The nailhead adheres to this sufficiently to remain in place for the first blow with the ham mer held sideways.



#### Nail and Screw Holders



To keep odds and ends of nails and screws at hand in a barn garage or work shop out the tops from a number of tobacco cans and nail these onto the side of any studding Place the supporting nails somewhat above the middle of the cans. The contents are made accessible by tipping the cans forward



#### Tiny Articles Soldered by Usina Hot Wire

VERY small articles such as tiny links of white metal costume iewelry can be soldered neatly with ordinary soft solder as shown above The 14 gauge copper wire takes the place of a soldering iron and the heat is regulated by moving the Bunsen burner When the end of the wire is hot soldering paste is applied and a warmed piece of wire solder is touched against it so as to leave enough for foining the parts -F D M



#### Percolator Serves as a Gluepot

A DISCARDED elec tric coffee perco lator can be used as an electric glue pot Place the in ner part of an orda nary gluepot in the open top of the percolator to hold the glue The water heats it quickly

#### Repairing Rusted Feet of Old Laundry Tubs

WHEN the angle iron legs of laundry tubs rust away at the base scrape all the scale off place a conical sheet metal mold around the leg clamp it shut and fill with molten lead as at the right. Then strip off the mold. In some cases it may be necessary to drill holes in each of the tuh legs to provide a strong key for the lead -Howard Lewis

Putty Knife Is Altered for

Scraping Cans

REMOVING the con tents of the com mon type of small namt can or any can having an edge turn ing mward will be easier if you cut or file away part of an

near the handle as shown in the sketch above The knife reaches into every corner It is also a handy implement for mixing the



#### Rubber Handles Improve Files

RUBBER hicycle pedal treads obtainable from a bicycle supply atore or taken from an old hicycle pedal make excellent file handles that will not come off in use yet ean readily he removed. The rubber is sufficiently flexible so that the file can be held easily in unhandy places and is less tiresome to grip -KOUDY KENNON





about 1/4" thick Any glazier will cut these for you In making the seat try to get as perfect a fit as possible. By coating the lens with lampblack and pressing down on the seat high spots will be revealed. Do not mount the lenses until the outside of the wood is shaped to its final form and the small brass eyes for the cord have been in serted in their holes and clinched inside

Apply shellac on the lens seat then a thin layer of plastic composition wood Press down with the lens to smooth the paste Re

shellae then set the lens permanently Clamp or put weights on the lens to hold it firmly until the shellac dries Finally apply composition wood around the edges on top as shown If

Vertical Section

BEVELED

move the lens apply

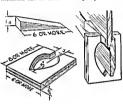
small shallow holes are first drilled around the inside they will serve to anchor the plastic material more firmly

The rim that fits around the eye should be beveled carefully so that the pressure will be equal all around The fiesh will yield enough if the wood is properly fitted to form a watertight joint G ve the wood two or three coats of shellac all over

To prevent fogg ng in use souk the gog gies in water of the same temperature as that in which they are to be used Wet the skin around the eyes and press the goggles on to create a partial vacuum insade This will make the eyes feel a bit queer but does not hurt The proper spacing of the two members can be determined by experiment.



A faily tight rubbe band keeps the goggles or



#### Baat-Planking Clamps

IF YOU do not have enough large screw clamps to hold the planks while fitting a doriveting a small lapstreak boat make up a dozen wedge clamps from two layers of; plywood as shown above The inner portion of the plaws is sawed larger so the clamps can be used on curves—J W RANKIN



#### Radiatar Hose Used as Galf Practice Ball

A 2 PIECE of 1%" rad ator hose may be used for practicing golf shots either indoors or outdoors with all clubs except the putter When ht it gives about tha same feel as a golf ball and it reacts to the way it is hit much as a regular ball does A perfectly hit shot will make it fly true and straight. whereas a poorly h t one causes it either to hook or alice If ht underneath pops up and top ping will makeit skit ter over the ground for some distance LOUIS R. JAFFEE



#### Grinder Set an Tractar to Sharpen Farm Taals

Ove farmer attached a grand ng wheel basse to his tractor as shown at the left This required but little more labor than squaring the end of a block of wood to fit one of the regolar sockets provided for attaching cuiti vauling equipment. Powered from the belt pulley of the tractor the grander is useful for putting mower knives cultivator show els and plowshares in good condition as well as for other odd jobs. Rover M Roarti well as for the rodd jobs.

#### Hikers' Lightweight Tent Pegs Cut from Bamboo Poles HIKERS, canocists, and cyclists who carry teather-

weight shelter tents on their trips can make a very light yet surprisingly durable set of tent pegs from bamboo as shown in the drawing at left below

A bamboo pole about 11, "in diameter is the best size to use One can often be obtained from furniture stores, which receive them in shipments of rugs. Cut the pole into sections by sawing about 11," above each joint, then split the sections in half. Start the notches below the joint with a saw then cut them out with a kinter, finally taper the other end. If bamboo smaller than 1" is

used it is best not to split it, but to use the material in the full round at the head

Each bamboo stake weighs but a few ounces and the whole set adds very little to the weight of the pack—CARROLL E BRADBERRY.



#### Shoes for the Beach Fashioned Out of Old Inner Tubes

BATHING shoes for walking on scorehing beach sand are easily made from a discarded automobile inner tube

Draw the outline of each foot on cardboard and use it as a pait tern in cutting the sole Each sole is made of three thicknesses of rubber. The crosspieces are cemented in place with rubber cement after two thicknesses of the rubber sole have heen cemented together. The length of the crosspieces is heat determined by placetes is heat determined by place.

ing them across the foot in their position.

The back part of the shoe is anchored by cementing a short loop to the heel as shown.



Extra rubber coment ed on the heel makes the shoes more com fortable for walking

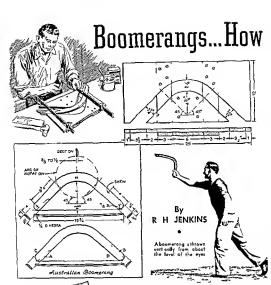


A rubber strap passes through this, crosses in front of the foot, and is attached to the crosspieces—FRANK CAPORAEL.



#### Vine Awning Changes with the Seasans

With the cloth on one of our awnings needer replace ment, I covered the framework with '," mesh hardware cloth and allowed a climbing vine to cover the screen completely. This awning may be called "automatic because it changes with the seasons, growing dense in the summer and practically disappearing in the lafe fall when the leaves drop off It does not, of course have to be taken down—A, J Viken,





Flot and rounded s des of a boamer ang made by gluing up this strips in the Lg shown at top of the page

ITS GREAT sport to throw the Australian bushman type of bomerang but its construction has always been a problem because of the d fficulty of hending the wood A simple solution is to give up the boom erang from a number of layers of thin wood in a form or jg made as shown above

Any mond will do for the \$i\tilde{g}\$ but be sure that the two curves are parallel when they are \$2\tilde{g}\$ apart. For each boomerang cut eighteen pieces of oak or maple \$i\tilde{g}\$ by \$2\tilde{g}\$, Apply waterproof casein glue on each piece clamp the whole mass at the \$i\tilde{g}\$ and let dry. Plane the hottom smooth cut out the shape and

Plane the hottom smooth cut out the shape and round off the top to about \( \frac{1}{2}\pi^2\) maximum thickness in the middle and \( \frac{1}\cdot\) at each end Bend up both ends by heat ing the laminated wood on top at the 6\( \frac{1}\cdot\) points and bending toward the heat this gives the required dishe dral angle or upward hend of about \( \frac{1}\cdot\) Skew or with a spokeshave the politic smarked \( A\text{ and } E\text{-from } 1\( \frac{1}\cdot\) as pokeshave the politic smarked \( A\text{ and } E\text{-from } 1\( \frac{1}\cdot\)

# to Make and Throw Them



sure to keep the curved face in toward sour body The throwing should be on soft ground The cross stick type of boomerang is

still easier to make Rip out two strips 3/16" or '4" by 2" hy 24' Find the center and glue together into a perfect cross. With the spokeshave, round off the top of each segment, working it thin on the edges but leaving the middle flat Round

off the ends, and hend up to get the dihedral angle from a point about two thirds of the distance from the end to the middle

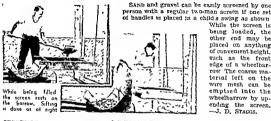
A %" dowel. 43." long, may be used in the middle, but not glued, as an aid in catching the cross stick boomerang Don't attempt to catch the other type

The first boomerang described could be made of alternate strips of mahogany and maple to give an inlaid effect, if desired.

enough For a leftbanded person, the

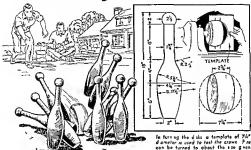
points must be reversed and the corners taken off are then at C and D Throw vertically, never horizontally, and at about the level of the eyes. Hold the boomerang at end B unless you are left-

#### Swing Holds Up End of Heavy Sand-Sifting Screen



While the screen is being loaded, the other end may be placed on anything of convenient height. such as the front edge of a wheelbarrow The coarse material left on the wire mesh can be emptied into the wheelbarrow by upending the screen. -J. D. STAGGS.

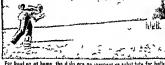
#### Lawn Bowling with Wooden Disks



HIS improvised bowl ing set which can be made in an evening or two can be used on either a well mown lawn or a smooth basement floor It provides an inexpensive way to enjoy the sport of bowling If a number of old In

dian clubs can be obtained they will serve as the pins Sometimes discarded clubs can be picked

up for little or nothing at a gymnasium As a rule however it will be necessary to turn the p ns on a lathe They can be turned to about the size and shape shown in an accompanying drawing but the dimensions may be changed if necessary to fit the available material Hardwood is better for the work but soft may be used



For bowling at home the disks are on inexpensive substitute for ba

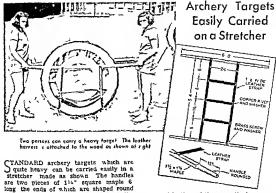
Each ball is made from a disk cut from 3" by 8" stock. The edges are turned to form a circular arc just as though each piece rep resented a part of a real ball. A template should be cut from thin wood to test the ac curacy of the turning

The bowling may be done with ten pins or played like the regular game of bowling on the green -R. J



#### Sunglasses for Emergency Use

THOSE who regularly wear spectacles can con vert them into efficient sunglasses when necessary by the method illustrated This idea has long been employed by the Eskimos to prevent snow blind ness It is an invaluable expedient when one is exposed to brilliant sumlight and eye searing re flections on a fishing trip at the beach or in the snow and has had no opportunity to provide regu lar sunglasses The spectacles continue to give the necessary optical correction -J E H.



Stretcher made as shown. The handles are two pieces of 11." square maple 6 long the ends of which are shaped round for about 12" so they will not hurt the hands. Two pieces of leather of harness thickness 67" long and 11;" wide are fas theid to the bars with 1" No 8 roundhead hrass screws and washers at points 12 on each side of the center Three 24 long

pieces of leather of the same thickness are spaced equally apart along the 64 lengths and fastened with flathead copper rivets and washers Sandpaper and stain the bars if deared then give the wood a coat of sheliac or varinsh—LESLIE D WILDING



#### Giving Liquid Medicine Safely to a Dog

THE easiest and safest way to give a dog inqui medicine is to pour it either from a spoon or a vial into the corner of the mouth. The dog's head should be held at an angle of about 45 deg and the first and second finger of the left hand used to part the loose flews at the corner of the mouth. Pour the medicine mot the pocket so made. The head then can be gradually tipped back while the jaws are being held shut. This will cause the dog to swallow the medicine naturally—W H FOSTE.

#### Knee Bands Repel Briers

HUNTERS campers and hikers know how annoying it is when hriers catch on the part of the sock that overlaps the top of the hoot or get into the hoot itself. To prevent this cut two hands of inner tube 3" or 4" long clean them thoroughly and slip one over each boot pulling it up until half the rubber extends beyond the hoot and covers the overlapping sock—JAMES E POLISSO.

The bond of rubber to ms a flex ble and confortable seal between the boot and the leg











# Marine Luncheon Ensemb**le**



RICH BLUE PLASTIC CARD HOLDER

ICH LOOKING, gemike hive plants material is used for this novel manne ensemble. It is intended to decorate a table for two but if additional place card and sait holders are made it will serve for as many guests as desired. Conventionained and some noncentral section of the conventional section of the convention of as time busins as results according startish serve as the candisholders see porses hold place cates in their months a nonses non prace varus in more mounts a baby turile carries saft a crabs back in filed with safted nois, cigarettes aprout from a scallop shell container, another scattrom a meanup such container, amounts scan-lop shell guards an ash tray and match top onen guarus an 430 tray and matter holder, while a modernistic fish forms the centerpiece. The designs are from the Met centerpiece the occasion are from the size ropolitan Junior Achievement, New York. repositan Junior Acineventus, men John All shapes are cut out with a head motor toof it hen carved with a head motor toof to then carved with a manu motor that a synlable Candleholders place-card holders

avenue - anotemotera frace-caro motocra and salt and not holders are each made in a and and and the manners are each manner in a single piece. The centerpiece has a base angle piece Auc conveyed was representing wave ripples, fastened on with strong figuid give or, better still, the special sing again sine or, weret sing the special comment supplied by the plastic manufactur. The combination ash tray and match er the communation and may and match holder is made in two pieces, cemental fo-Rether as shown The cigarette holder requires three pieces Polishing is done as builtied in Previous sticles of this series cups to fit the nut and sait holders, and

to form ash trays, are made of pewter

Marrow strips of pewter are first bent to Mariow Minps of pewier are first pent to form rings, then the bottom places are cut out and soldered outs them with very soft, low melting solder

#### Leather Album Converted into Stationery Box



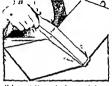
With a sharp knife, all the pages are cut



LD-FASHIONED photograph albums or large leather covered books can be converted into attractive boxes for stationery, candy, trinkets, and the like at practically no cost.

Measure the length, width, and thickness of the leaves only (not the covers) From these dimensions make the four sides of the frame or box from 3,16° soft pine or baskwood strips. Have the strip along the hack slightly wider than the other sides

While the give on the frame is setting, cut all leaves except the flyleaves (if any) away from the covers. Fit the frame into the cover, and give the hack and the lower edges in place. Give a strip of cloth along the inside edge where the cover hinges on the wood frame. The outside edges of the box are painted with gult and then given a coat of dull agreement. W. C.



Make a suitable wooden frame and glue it to the back and battom cover of the book

#### Altered Chopping Bowls Form Attractive Fruit Holder

AN ATTRACTIVE fruit boul may be made from two maple chopping bowls With a jig saw, cut no bowl out as shown, leaving a handle \*s,\* wide As the bottoms of most chopping bowls are comparatively in, it is a good idea to reinforce the bandle by gluing a small stim of manle on the ton sude

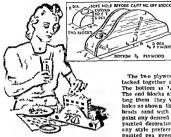
The edges of the bowls must be sanded smooth and flat to fit together perfectly. To make a strong joint,

But to fit together perfects short 37.6° dowels are unserted and glued in holes drilled at intervals around the edges of both bowls Rubber bands cut from tuner tubes may be used to hold the bowls except while the glue sets. Then remove the bands and give the edges at horough sanding Two coats of flat-drying variable gives a soft finish.



CRAFTWORK

#### Colorful Table Novelty Holds Paper Napkins



This gayly paint ed napkin set lends added color to a re freshment table or tray when snacks and tithits are served. It holds a supply of amall square folded paper napkins and colored toothpicks for spear.

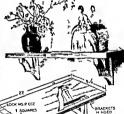
Ing hors docurred. The two plywood mote 37.6° thinks are tacked together and acroll sawed at once The bottom as ", plywood 11," by 8°. The end blacks are maple. To avoid split tog them they were first hord with ", boles is ahown then cut off. Assemble with bracks and with ho 0 garnet paper and paint any desired color. Transfers or hand painted deportations can then be sidded in any style preferred. The holder shown is painted plear green—BRICE MICLY NOSI.

#### Portable Shelf Cantains Its Own Brackets

NE p see of wahut 51, by 22' turn shed the makeral for the port side shelf which folds flat for shipment or storage after being jug sawed as shown the brackets are hinged with nails. The heads are cut off and the nails driven below the surface so that the holes may be concealed with shivers of walnut which are glued into place and sanded smooth.

Note that the brackets are designed so that they can be locked in the open position by means of two small locking pieces. All surfaces are saided to smoothess and then an side with shellar. The shell is shung on L shaped screw hooks set firmly into the wall—FRAN WHEELOGAN.

Backets and shefae g sowed fam one pece Note the agenous lack to hold ag the backets a post on

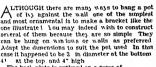


The shelf may be folded flat for an prient o storage lt hangs on two L shaped hooks

#### Tiny Parts Cut from Paper

Very small ship model fittings such as boom and gaff jaws and other t ny craft work parts susually made of wood can he cut from six or seven layers of bond paper glued together with cellulose cement

#### Ivy-Pot Bracket of Hammered Copper



41 at the top and 4" high
The buch plate is outlined on a piece of
14 gauge soft sheet copper and is cut
with the tim shears and a cold chise! shie I
smooth an I hammered on the face. The
bracket parts and the bund are, cut from
16 gauge stock and are hammered an!
formed as shown in the drawings. The
drip pan is a disk of 15 gauge soft sheet
copper. It is raised to a depth of about

a. then the bottom corner is formed Assemble all parts with to 14 brass rivets or escutcheon pins. Stab the surface with a liquid solution of copper in trate and heat until black. Dust off and repeat until completely black, then wax with floor wax and police.

Iron may be used in place of copper and painted a i black -- Dick HUTCHIN ON

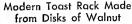


The parts are riveted tagether as at right Below forming bottom corner of the drip pas

BAND BENT



CRAFTWORK



Thus decorative toast rack consists of seven calks of \$%' wahut cut 5' in diameter and six maple separators cut from \$%' stock to the shape abown. The pieces are assembled with \$%' birch or maple dowels A wainut handle is scroll sawed as indicated and attached to the center withing the seven seven seven to \$\frac{1}{2}\text{ of webs.}\$ When the content of \$\frac{1}{2}\text{ of webs.}\$ When the content is the content of \$\frac{1}{2}\text{ of webs.}\$ When the content is the content of \$\frac{1}{2}\text{ of webs.}\$ When the content is the content of \$\frac{1}{2}\text{ of webs.}\$ When the cont





#### BROWN AND GREEN COLORS

#### [ METAL WORKING ]

The following formula will produce a permanent finish either brown or black on copper brass bronze or mickel silver

Flace some commercial attre soul in a glass jar and dissolve all of the scrap copper that the acid will consume thereby producing a liquid copper intrate. Do not allow this solution to come in contact with the hands or clothing Using a swab root the surface of the piece to be colored with the send Apply Using a swab root the surface of the piece that green then brown Stop the heat the moment the piece is all the towns fair green then brown Stop the heat the moment the piece is all the stop of the piece of of th

About three hum ngs will be required to produce a good black finish. If the brown finish is used burnesh the halph lights on the hammered parts with fine emery paper Polish the finished work with ordinary floor wax No lacquer is necessary.

A satisfactory verd antique or verdigrin green finish may be produced by coating the piece with copper intrate as above and allowing it to dry in the sun or in a warm room. When thoroughly dry coat with lacquer. This is excitlent for out-of-doors work such as lanterns hardware and copper trim

FORULAR SCIENCE MONTHLY SHOP DATA FILE

#### New Marble Gome Tests Steadiness of Hand

'MOUNTAIN CLIMBER is a fascinating new table game in which marbles are pushed up an incline with the ald of a small fast stick until they fall into numbered holes although the game may look easy the marbles have a tendency to roll off the side of the stick A good score therefore ealis



The object of the game is to push marbles up the mountain so that each stops in a numbered hole

for steadiness of hand and calm nerves Considerable practice is required before one can control the marbles

Each player is given five marbles for the climb When all have been used the ones which have been successfully deposited in holes are counted according to the value of the holes The highest score wins

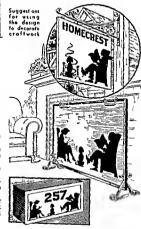
Once a marble drops into a hole it cannot climb again. When a marble falls down the mountain it is lost

Whether made of heavy cardboard or wood the incline should have a smooth flat surface Paint or wax crayons may be used for the decorations.—Myron Fleishmay



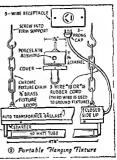
## Silhouette of the Month: "Fireside Comfort"

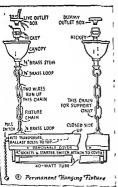
HERE is a silhouette that can be adapted to many purposes. Scroll sawed from ply wood the figures can be used for example as a name board or to ornament an illumnated house number. Cut from sheet metal they will decorate a fireplace screen. Since they are separate the figures can be set as far apart as the individual project requires or they can be used individually. Any degree of enlargement may be obtained by given of enlargement may be obtained and copying the outlines through the squares from point to point.



# BUILDING FFUNOIPESCEME







THIRD problem in building fluorescent lighting fatures is where a portable fature is deared, and the ceiling height is such that the lamp must be suspended on chains The fature is made as before (drawing D), but it is suspended by means of two brass loops and chains, as at F A rubber cord and plug allow connections to be made to a three-ware polarized receptacle

Reflectors can be easily added to any of these fixtures by bending up the material to the required shape, as shown in drawing G Polished sluminum or sheet metal straved with white enamel or lacquer gives

a satisfactory surface in general, 15 watt 20 watt, and 40 watt in general, 15 watt 20 watt, and 40 watt lubes are 1½ fo diameter and have a comparatively low surface brightness. Because of this they can be used exposed without reflectors and will give a good spread of light all over a room. On the other hand, the 17 diameter 15 and 30 watt tubes are somewhat brighter and should be used in a reflector when possible to protect the even

One of the main features of the fixtures illustrated is the use of the new separate starter switch Formerly the switch and reactor were combined in one unit called an auxiliary II the switch went bad the whole

# Lighting Fixtures

PART TWO

#### By HAROLD P. STRAND

unit had to be replaced. The latest advance in the industry is a small starter switch which is easily inserted and removed from the bottom of the fixture. With this is used a simple ballast or reactor.

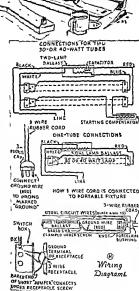
If, however, 30- or 40-watt tubes are to be operated an auto-transformer must be used with the starter switch and it also longer tubes do not operate directly at the low 115 voit pressure, but must have equipment to step it up to the required voitage

An excellent method of hanging fixtures permanently on chains is shown at F

When making fixtures using two tubes a two lamp beliast unit can be substituted for two belliasts This contains a capacitor correct low power factor and ficker, and makes an efficient control unit However, care must be taken to see that the channel dimensions are sufficient to accommodate the larger unit When using the commodate the larger unit when using the larger than the larger unit when using the larger than the larger unit when the larger unit of the larger unit when the larger unit of the larger unit when the larger unit of the larger unit when the larger unit was the larger unit when the larger unit was the larger unit when the larger unit was the larger unit wa

With single-tube fixtures the low power factor that is characteristic of fluorescent lampa can be corrected by installing small capacitors in the channel If preferred, however, a larger one can be installed elsewhere to take care of several lamps For an individual lamp, a capacitor of 475 microfareds will bring up a power factor of about 50 percent to nearly 90 percent A capacitor of 17 5 microfareds can be used for five 50- or 40-watt tubes with a thermal type auxiliary or starter to obtain 90 percent power factor. These devices are consected across the line at or near the ballast

Fluorescent lamps can also be operated





Fluorescent fatu es are ideal for the laundry room

on direct current with some success In general only the 15 and 20 watt sizes can be used because it is not possible to step up 115 volt current to the higher voltage for starting the larger lamps

vottage for starting too larger amps of the only change necessary for De sizes with the reactor or ballast to limit the current. Care must be used to ven blate the resistor properly because of beating and connections should be made with wire having heat resuting musils into at 120 vots the 15 watt 78 tube requires a resistor of 186 chins and the control of the size of the control of the

The construction described is stand and practice but some localities may have adopted special regulations so ask your electrical inspector if in doubt

with A C operation

#### Foil-Lined Lamp Shade Acts as a Reflector

BY LINING them with metal foul metal lamp shades like the control one shows can be made into efficient reflectors that con centrate the light mainly in one direction. The foul can be fastened by coating the shade surface with spar variesh enamel or baking enamel letting it dry upit tacky and then pressing the lining into contact. It can be smoothed out to make a good specular (mirrorithe) reflector or crunkled to scatter the reflected light over a wider angle



#### FLEXIBLE CORDS TO USE

#### [ELECTRICAL]

When an electrical appliance requires the replacement of its cord select the proper type of cord to insure safe operation as follows

The	Trafe name	Type	Outer covering	
F at from loanters wattle from grills from hea ers mang es used in dry p aces	Beater cord	HPD	Cotton or rayon	
Reating use damp places	Rubber jacketed heater ford	H87	Cotton and rubber	
Lamps smal rad on 1 ght appliances dry p aces	Parallel cord	PO 54 PO 32 PO 54	Colton or rayon	
Lamps ele damp or dry plates	All rubber Parallel cord	POSJ 54 POSJ 32	Rubber	
Vecuum cleaners large radios dri s refrigerators washing much ses shop motors etc damp or dry p acces	Juniar robber cord	BJ	Rabber	
Extra hard usage or heary duty	Hard service rubber cord	8	Rubber	
Subject to mechanical injury dry places	Ammored refin	PA	Colton and metal	

POPULAR SCIENCE MONTHLY SHOP DATA FILE



## BX-Conduit Saves Time in Coiling Fish Tape

O'E electrician coils his fish tape through an 18 piece of EX so it can be handled rap idly without kinking By bolding the fiext ble EX in one hand and revolving the rolled steef fish tape with the other hand he feeds the tape into the conduit swiftly

#### Attaching Wires Quickly

IN EXPERIMENTAL work whree can be connected temporarily to sheet metal or screen wire with brass paper fasteners of the type shown Insert the wire into the fold of the fastener and squeeze shut over the edge of the material For sheet metal punch a small hole Solder for greater permanency



### Soldering Copper Heats

Ranio repairmen electricians and others having occasion to tin wires or similar small parts will find the miniature electric furnace libertrate below a great course lenges

The brass crucible is a short piece of brass rod of a diameter slightly greater than the length of the small soldering copper head A hole is drilled to receive the copper and another to form a cavity for the molten solder. The crucible is piaced in a bousing made by cutting down a tin can and sur rounded with thermal insulation such as glass wool absents or plaster. A tube made from a piece of the tin can connects the lateral bole in the crucible with the out is de of the bousing. If the insulating material does not hold the parts securely fasten the crucible with a machine screw through the bottom of the housing.

The soldering copper may require ten or fifteen minutes to beat the crucible to the melting point of solder. The process can be hastened if necessary by directing a toreb fame into the furnace from the top. A lid made of asbestos or other suitable material will reduce the escape of heat from the top. To tim wire ends coat them with flux and dip them into the motien solder. The solder ing copper can be removed for several mutues at a time without permitting the solder to soldsty. It is best to place a thin layer of insulation under the furnace so the bench top will not be scorebed if the metal be comes too hot.—ENIN, WALTES.





the mal nsulator was sand which was covered with wood fiber ples ter after the device had been tested

# Stopping Action



By R. O. LISSAMAN

HEN you photograph a moving person animal or object the image moves across the surface of the -that is the focal plane of the camera-for the duration of the ex posure For the action to appear completely stopped the exposure must be brief enough to permit a movement of not more than about 001 when the finished print is viewed at normal viewing distance Although an image displacement of 0 01 will be satisfactory for a contect print a negative that is to be enlarged must show lese movement than that For ex ample if it be desired to enlarge the negative five times the film should have an image displace ment of not more than 0 002 An accompanying table gives the approximate exposure for stopping action of various

Fagt rate at angle to comera First man



Act on directly across the cameral as in this case requires faster expasure than movement at an angle

## with Your Camera

the slowest that can safely be used. In each case for action of 20 m p h, or faster, three eneeds are indicated. The fastest is for use when the movement is across the field of vision from right to left or vice versa. The second is for movement at an angle, and the third or slowest is for movement approaching the camera. The table is based on the average focal length of lenses in popular use, that is, a 2" lens for miniature cameras and a 4" lens for a camera using

the so-called twenty size film

For contact prints, a short focal length lens, such as those used in minlature cameras, will show less image displacement with the same action and same exposure than a lens of longer focal length If enlargements are to be made, remember that the greater the enlargement desired. the shorter the exposure must be Close-up action requires shorter exposure than does distant action

Although the table gives all the information an amateur is likely to require in learning to make good action shots, there are some photographers who are keenly interested in theo-

Approaching action at a speed about 35 m b h An exposure 1/200th second stopped it

ry For their benefit the following formula is given for working out the exposure necessary to stop action in any individual case All measurements must be given in inches

1 Distance object will move compared



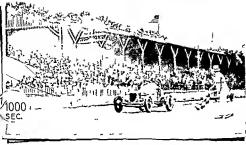
#### EXPOSURES TO STOP ACTION

#### [ PHOTOGRAPHY ]

Exposure for average ministure curpers		erage era	Action	Per hour	Exposure for average		
1/15 to 1/50			Average views pe destrings etc	race views pe 5	1/25 to 1/100		
$\leftrightarrow$	M	1			$\leftrightarrow$	X	$\overline{\downarrow}$
1/100	1/65	1/40	Athletic events foot reces boats baseball slow street tradic etc	20	1/200	1/130	1/80
1/200	1/130	1/60	Brisk traffic borse races motor boats diving etc	30	1/400	1/260	1/120
1/350	1/250	1/125	Highway traffic birds on wing pishes fast trains etc	60	1/700	1/500	1/25

ofe. Use the shutler speed closest to the given sp nould not be hand held, especially if enlargements

POPULAR SCIENCE MONTHLY SHOP DATA FILE



Snapping the firsh of an auto race takes real speed especially if you intend to enlarge the negative

with permissible image movement which can be stated Displacement permissible  $\times \frac{\text{Distance to object}}{\text{Lens focal length}} \text{ or } \text{Disp} \times \frac{\text{D}}{\text{F}}$ 

2 Distance object will move in 1 second At 1 mile per hour 5 230 or 63 360 object will move 63 360 or 1 056 in 1 minute

and  $\frac{1056}{60}$  or 17 6 in 1 second

Thus the formula may be stated
Required exposure in seconds:=

Disp  $\times \frac{D}{F} - (17.6 \times mph)$ 



#### Scoop for Small Bottles

A scop for getting into small necked bot the when weighing puto chemicals may be made from a face powder scopp of the type shown above. These scopps are designed for filling compacts and usually self for filler cents. All that is necessary is to extend the handle with a section of discarded knitting freelie or a small dowel.

Example To photograph a train at 60 mph, at 50 (600") distant with lens of 3" focal length  $\frac{1}{100} \times \frac{600}{1} = \frac{17.6 \times 60}{1} = \frac{1}{100} \times \frac{600}{3} \times \frac{1}{17.6 \times 60} = \frac{1}{100} \times \frac{600}{3} \times \frac{1}{17.6 \times 60} = \frac{1}{100} \times \frac{600}{3} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} \times \frac{1}{100} = \frac{1}{100} \times \frac{1}{100} \times \frac{1$ 

100 × 3 - 1 00 × 3 × 17 6×60 1 econo

528 secon

This gives the exposure when the move ment is passing directly across the camera field of view. Action approaching or leaving the camera at 36 dag may be stopped with one third longer exposure. Action directly approaching or leaving may be stopped with two thirds longer exposure.

#### Roll-Film Tank Corked to Keep Out Dust

AFTER using a roll film developing tank it is advisable to plug the opening in the hid with a small cork or a pledget of cotton to keep out dust and chemicals that may be floating in the air—E A B



WHEN I have to make several prints of a photograph I borrow the metronome from its place beande the piano. By counting its ticks I can time the exposures and also the developing period—FREMINAND G HLT



#### Wet Prints Trimmed Easily with Knife

If no trimming board is available by far the easiest way to trim photo prints surprising as it may seem is immediately after they have been washed and while they are still wet

Place a wet print face up on a smooth board, such as a bread board a plece of plywood or a drawing board, and cut it with a very sharp, large pocketknife blade a bunting knife, or any other stiff-bladed knife A large drawing triangle makes the best guide because it gives greater safety to the fingers and can be beld down better

than a ruler -O P SHIER

#### Avoiding Finger Marks When Loading Film

FINGE marks on film can cause irreparable damage, especially in warm weather or in a hot, poorly ventilated darkroom, when one in fagers are likely to be quite most Such blemishes are easily avoided, however, by using a pair of soft chamols fager cots for the thumb and forefinger. These will absorb moisture and protect the film while a tank or film cartridge is being loaded.

Cut a rectangle of paper 2° by 3° for the forefinger and another 11° by 4 for the thumb Wrap them around the fingers, mark the approximate size and shape, and use them as patterns for cutting the chamous Stitch the cots as shown fitting them so tight they wont slip off Make a new pair when they begin to get durty or collect too much list —NATIMA SPERBERS





#### RETOUCHING PRINTS, PART I

#### [ PHOTOGRAPHY ]

With Artist's Black, Oil Color. First, apply a sizing medium to entire surface of print with a way of cotton (A good sizing medium consists of 10z turpentune, ½ 0z, inseed oil, and from 15 to 20 drops of japan gold size. Shake together well and let stand overnight.) For shading large areas, charge a cotton wad with black oil paint, and rub it on waste paper until the color can be applied lightly and evenly. For smaller areas use bits of cotton twisted on the end of a toothpick or a paper stump. For lines and spots, use a spotting brush and thun the color with turpentine Remove undesired or surplus color with the sizing medium. A scrap of glass will serve as a paletic.

With Printer's Ink Ottain half-tone black from a local printer or printing supply house No sizing medium is required. Use like oil color, but thin with artist's pale drying oil. A soft eraser will remove undesired ink while still wet. This is a versatile medium and leaves such a tough film that glossy prints reduced with it may be referrotyped.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



J. W. CLEMENT

SCEPTIONALLA light
strong buils for model
speed boats can be
gummed paper laid over a
form cut from a solid piece
of balss or white pine The
form Fig 1 should be accu
rately shaped but need not
have a perfect surface

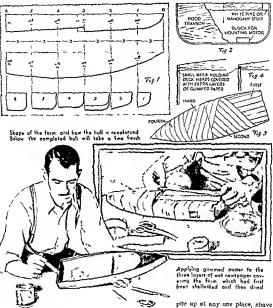
If your model is to have a deck it should be fitted to the form and held in place with two small brads or weak glue so that it can be removed aft

er the buil is dry When a steam power plant is to be installed, a deck will only be in the way and it will be more practical to receforce the buil, after the form is re moved, with strips of white pine or mshog any as shown in Fig 2 The transom may also be made of wood fitted to the form and flued in place the same as the deck As you may wish to use the form again it is a good plan to give it a coat of linseed oil or hot paralim. It is then covered with strips of wet newspaper laid approximately three layers deep. No glue is used.

The gummed paper which goes on next, should not be over 1" wide Cut off pieces a little longer than the form and, after dip



## FOR MODEL SPEED BOATS



ping them in water, lay them lengthwise from stem to transom, parallel to the keel. The strips should lap about one quarter of their width. The second layer of paper apput on diagonally over the form, and the third layer at right angles to the first diagonal layer.

Wherever the strips have a tendency to

them down while wet before putting on the next layer Also add small pieces where needed so that approximately the same number of

layers make up the entire hull If the bull is 18" long—a good size for your first model—five or six thicknesses of the gummed paper should be sufficient to withstand all ordicary usage

When the hull is completely dry, it should be smoothed up with sandpaper and given two or three coats of paint Sand each down Next remove the paper hull from the form Strips of wood are gived to the hull along the edge blocks are fastened to the bottom to hold the motor and another block as placed at the step to take care of the propeller shaft tunnel If you have used a wooden transom brads should be driven in around the edge to hold it in place Stick

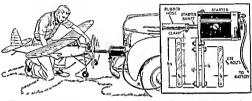
additional strips of paper over the heads of the brads to cover them and repaint

The made of the hull should be finished with two coats of varnish Be careful that all corners are covered because any place left exposed will absorb moisture and run

the hull

With this method several duplicate hulls
can quickly be made for competitive racing

# Electric Starter Spins Model Airplane Props



THIS electric starter for model airplane gas engines will overcome the starting troubles usually encountered at model air plane meets

An old 6 volt auto starter motor is ob tained and reconditioned A piece of garden hose 6" long is securely fastened to the starter shaft with a hose clamp then spit back shout 1" at the other end so it will flare out and fit over the nut on the propeller shaft. The starter is clamped securely as shown to the bumper of an automobile to which it is grounded and the cable which should be heavy enough to carry about fifty amperes is clipped to the ear battery

The fiyer holds his model plane in position with one band so the propeller hub presses against the hose on the shaft of the starter and then uses the other hand to adjust the gas needle. A plane motor usually starts in a few seconds—ARPHUR C STROHM

### Painted Scene Sets Off Miniature Railway Layaut

ANY ordinary model train dis play can be made more at tractive and realistic by a painted background showing scenery The background illus trated was painted by a pro fess onal sign painter on a piece of oilcloth 3 high and 8 long (the length of the lavout) Brown dark green and tan show card colors were used in depicting the mountains and blue in several shades and white completed the sky While the paint on the mountains was still wet artificial snow was sprinkled on to give a snow capped effect Large travel posters often pro vide sultable scenes -C E. B



D splays become much more real st a when backgrounds are added







# THREE Guild Clubs WIN NATIONAL AWARDS

N RECOGNITION of their excellent work POPULAR SCIENCE MONTHLY IS awarding large silver plaques to the three home workshop clubs that led the National Homeworkshop Guild during the past sea son in the fields of civic activities crafts manship and programs for club meetings

The award for civic activities goes to the Long Beach (Calif ) Homecraftsmen s Club Its 110 members con structed 5 010 toys for distribution to poor children through the Christmas fund of a lo cal newspaper and 359 additional toys for the Salvation Army a Mex ican mission and spe cial cases. The club al so made shipping boxes for bandages and cloth ing sent to Finland and Poland first aid splint sets for the American Red Cross game boards for the social room of a church and envelope

The Sag naw Homecraft Club presented ts entry n the form of a beaut ful al bum having veneer pages on which were photos and a descript on of the project

for his work

#### FIRST IN CIVIC ACTIVITIES Long Beach (Colf) Homecraftsmen : Club FIRST IN CRAFTSMANSHIP

I mberc aft Homeworkshop Club New Bedford Mass

FIRST IN CLUB PROGRAMS Portland (Ore ) Homeworkshop Club HONORABLE MENTION

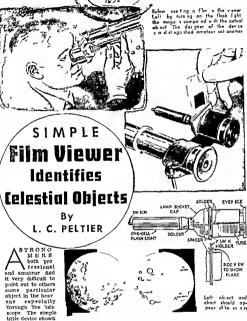
CIVIC ACTIVITIES-Ashtabula (Oh o) Hom craft Club Columbus (Oh o) Homecraft Club Sag now (M ch ) Homecraft Club CRAFTSMANSHIP-B son Homeworkshop Gu id

containers for 100 pews in another church The Timbercraft Homeworkshop Club New Bedford Mass wins the craftsman ship plaque through the efforts of Charles Jeghnski its secretary who designed and huilt the nautical chest de

scribed elsewhere in this issue Mr Jeglin ski will receive a spe cial craftwork medal In the program divi

sion of the contest the Portland (Ore ) Home workshop Club carries off first bonors That club was the subject of a recent feature article (PSM June 40 P 164) By means of its bigb standard of programs and an extensive publicity campaign it has built up a large and active membership



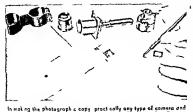


however will unerringly point out a special star in a field full of stars of similar ap pearance

It consists of a metal film holder to one of the of which is soldered a tube for holding a magnifier or eyepiece and to the opposite side is soldered a small flash light. A flash light clamp such as is used on automobile steering posts holds the device on the tele scope tube so that the observer can see

through both telescope and viewer at the same time A greatly reduced photograph is made of a chart or sketch of each region or object to be identified This negative is placed in the bolder and the object seen in the telescope is compared directly with its corresponding film image seen by trans

mitted light from the flash light
Owing to the great reduction it is usually
possible to make two or three transparencies



film can be used Each chart's numbered for easy dentification

on one negative and then divide and trim them to size after development. It is of course best to make the copies to a scale which will correspond approvi mately with the telescopic view For example if the telescope shows the entire moon in one field of view the transparency when viewed through the magni fier should show a moon of similar size Standard astronomical charts can be photographed or you can draw your own

## Neon Lomp Tests Circuits in Home Laboratory

AN ORDINARY neon glow lamp is a very versatile test lamp for the home laboratory or shop Used as shown it will indicate which terminals are live approximately what voltage is present its frequency and if D C its polarity

The built is a 2 watt 115 volt neen lamp coating 45 cents It has been screwed into a 10 cent pigtall socket after the ends of the wires were stripped and tinned In constant use for over three years on all voltages and frequencies it has saved many bours of guessing circuit tracing and un Becessary shock.

Unlike an incandescent lamp the neon to the total may be used on voltages ranging from 70 to 550 volts without damaging the bulb and it will light through resistances as high as 750 000 ohms for continuity testing. The approximate voltage present may be de

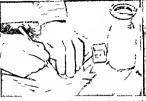
terminated by the in tensity and color of the neon glow once you have noted the appearance of the glow under specific conditions. The fre quency is shown by the way the plates ight up Sixty cycle current shows as a steady glow on both plates 25 cycle cur rent has a very no ticeable flicker and on D C only the plate connected to the positive side of the line tested will become illuminated -R B STETSON

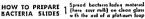




## No Fooling—Oily Rags Are Really Dangerous

Every home worker has been told many times not to leave oil or pant saaked rags around his shop or laboratory but it is difficult to understand how great the danger is until a fire actually starts and then it may be too late. The accompanying photo graph taken by a contributor to this de particular them by a contributor to this de particular the burst remains of an apron used by a high school student. He had been finishing a project on the lathe by rubbing it with linssed oil and untilhishingly rolled up the oil soaked rag in his apron and placed them in his deak frawer. The building custodian found the smoldering apronur bours later and extinguished the fire







Kill and fix bacteria by holding the glass for a second at a time three times in an alcohol or gas flame

# STUDYING BACTERIA



#### By MORTON C. WALLING

DACTERIA, the tuny plants that are the smallest and yet one of the most important of all living organisms, provide a facunating and advanturous subject for the amateur microscopist. Or the many steamer, while others are destroyers of human and other animal life. But all are interesting for microscopie study.

Where can you find a supply of bacterna for examinating. The closest source is your cown mouth, for if you touch your tongue to a microscope adde, or excape, your teeth with a toothpick, you'll have a ready supply of microorganisms for examination under your less Easteria may also be obtained from raw milk, butternilk, finger-pail dirt, decayed matter, thicken livers, and a hundred other cources

The organisms are so tiny, however, that

BASIC FORMS
(Batts Rods, and Spirals)

DEGINITARY
CAPSULES AND SPORES

DEGINITARY
FORMS
(Call Shaped)

VARIOUS COMMON FORMS

Princ politypes of bacteria you will see under your in croscope are shown in the diagram of right. The sooner you memerite them, the more fun you'll have



3 D ssalve for away with rylal then drop dye solution on the specimen Heating speeds up dyeing

After staining rinse the glass in water to remove the excess dye

5 sto ned odd o little alcahal and quickly rinse with water

with Your MICROSCOPE

they must be specially treated to make COCCI
them more rushle under your lens This is
accomplished by the process of staining

used methods of fixing is to spread the bacteria-containing material, to which water may be added if necessary in a thin film on a clean microscope slide or cover glass let it dry. Then grasp the glass with tweezers and pass it bacteria side up through the fisme of a bunsen burner or alcohol lamp three times taking about one econd for each passage. All bacteria will then be killed and fixed, and you are ready for the next step staming. There are many stams suitable for

here are many seams backers, some of a general type to make any bacterium easy to see and others of a selective type to color some bacteria and not others' thus helping the microscopist to tell one from the other At first you probably will find it sufficient to use a single easily handled stain such as Loeffler such probably will find the sufficient of the sum of the sum

To make this mix thirty coline centimeters of a saturated solution of methylene blue in ethyl alcohol with 100 cubic centimeters of water to which two drops of ten percent potassium hydrowide solution have been added. Now lay the shide or covergiass on a level surface and drop enough stam on it to cover the bacteria material. Let the stam act for from three to five minutes and then ruse in clean water. Often a die will stam bacteria better if

. \_\_\_ .



the glass is beated enough to make the dye solution steam but not boil, as it is dropped on.

Having stained the bacteria specimen, you are ready to apply a cover glass if your specimen is on a side or slide if on a cover glass For permanent mounting use neutral Canada balsam readily avail able specially prepared for slide making Place a drop of the balsam on the stained film and lower a thin cover glass in place on top of it.

In examining your clides under the micro-

in examining your choes under the increscope refer to the drawings on this page or to a book on bacteriology to help you pot the distinctive shapes and arrange ments of bacteria that reveal their identity

# Latest Aids for

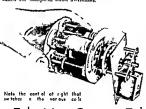
## Push-Button Switch Controls New Five-Coil Wave Unit

CONTROLLED by an electric push button mounted at any convenient spot on the transmitter panel a compact set of five coils covering 10 20 40 89 and 160 meter bands instantly switches over to any one of the hands when the push button is pressed. The time and trouble saving device shown in the illustration below shifts bands through a magnetic or solenoid coil mounted on the assembly itself. The tuning coils are set radially around the unit and each has its own midget 35 mmfd, tuning condenser which is pretuned for complete band switching



# New Weighted Knob Simplifies Tuning

CALLED an inertia tuner the knob shown above attached to the tuning shaft of a receiver is made of heavy metal and is two inches in diameter Because of its weight and size it con tinues to spin when given a twirl thus reducing the amount of manual knob twisting necessary to swing be tween widely spaced wave lengths The knob has a 14" hole to fit most tuning shafts. On either the main turing or band spread shaft, it gives a smoother touch to tuning

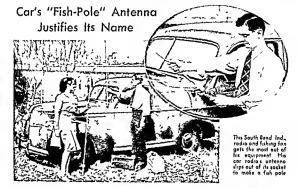


# Television Camera Tube for Amateurs

RADIO amateurs who would like to experi ment with televis on transmission as well as reception can now do so with a new inexpen sive televis on camera eye tube just placed on the market. new tube is capable of transmitting a televi s on picture 11, " square composed of 120 lines According to the law anyone holding a rad o amateurs license can operate an amateur tele vision transmitter on the 214 meter and short er bands



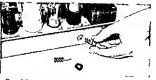
# Radio Enthusiasts



THE "fish-pole" antenna on the cowl of a South Bend, Ind, radio fan's car actually is a fishing pole Finding it gave him good reception, he fitted a regular steel fishing pole in the antenna socket. Now, when he arrives at a stream, he removes the pole from the car, inserts it in its regular rod butt, and is ready to fish

# Spiral Jack-Cleaning Brush

DESIGNED for cleaning dust or corrosion from the insides of radio jacks, a small spiral brush that fils the chuck of an ordinary hand drill its now available inserted in the jack and revolved, it quickly wipes all surfaces clean



One of these tiny brushes will clean out a tack in a pity



## Static Muffler for Automobile Radio

STATIC electricity that ordinarily collects at the tip of pole antennas on automobiles discharging with a violent crackling sound in the receiver, is said to be discharged gradually by the new antenna tip flustrated above The static 'muf fier' consists of a small plastic bail gradied by a metal ring around its center. The metal ring, by allowing any static charge to leak of slowly, eliminates most of the annoying discharge noises

# Get Started in



Any good rad a supply store has the parts listed at the right. With them you can build this circuit and five more to be described in the pext five issues

## BY ARTHUR C. MILLER

F YOU have always wanted to experiment with radio here's your chance. With the parts Insteal at the right, costing about \$8.95 you can build six modern radio circuits—six different radio hook ups specially designed not only to use the sante parts but to provide a good course in general radio construction and theory.

The first circuit described in this actiels, as ample two-tube all-electric earphone receiver a simple two-tube all-electric earphones set will be given and in succeeding months a four-tube speaker receiver, as three tube phongraph amplier, a three-tube tuned ratio-frequency circuit, and a four-tube tuned ratio-frequency circuit, and a four-tube tuned ratio-frequency in the part of the first purchasing the parts lasted, fogether with the necessary connecting wire, ruse ethers, and the properties of the purchasing the parts lasted, fogether with the necessary connecting wire, ruse ethers, and the properties of the properties of the purchasing the parts lasted, fogethers, and the purchasing the parts lasted to the parts lasted to the purchasing the parts lasted to the purchasing the parts lasted to the part

INEXPENSIVE PARTS
YOU CAN BUILD SIX
CIRCUITS DESIGNED
TO TEACH THE TRICKS
OF SET BUILDING
AND REPAIR

#### WHAT TO BUY

.55

15

.13

.40

tn

.28

22

.26

40

18

16

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18 95

Line cord 135 or 160 ohm Filter chake 20 h , 500 ohm Corls plug in 100-570 meters [2] Vorsable condenser, 00014 mfd Mica condensers [2] 002

Mico condensers (2) 002 mfd Mico condenser, 0002 mfd Mico condenser, 0005 mfd Duo! efectrolytic condenser,

Dual electrolytic condenses, 16-16 mid., 250 v Shielded poper by pass condenser I mid., 200 v... Tubular poper condenses, 200 mid., 600 v...

Electrolytic condenser, ID
mfd, 25 v.
Pentode-triode tube 2588GT
Pentode-triode tube

TOLIGT
Carbon resistors (4) 1/2 watt
1 mag
Carbon resistor, 1/2 watt.

200 000 ohm .10
Carbon resister 1/2 wett.
(50 000 ohm .10
Carbon resistor, 1/2 wett 600

ohm Yorioble resistor 25 000 ohm Yorioble resistor, 250 000 ohms

Sizinch magnetic speaker Four sinch dial Octol molded sockets (2) Sizince molded socket Rotary S.P.S.T switch R.F. choke 25 mh

♦ TWO-TUBE ELECTRIC ♦ THREE-TUBE ELECTRIC ♦ FOUR-TUBE ELECTRIC

# Radio for \$8.95



Atright assembling a two tube all elect is bioadcast receiving set the first na se es of sa

ROTES

in conventional radio wining diagrams, symbols are used to indicate the varieus parts such as condensers, resisters, and coil windings. The most common symbols are shown above. Abbrevlations also are used to indicate the specifications of the parts. The mest temmen of these are mfd\_ microfored mmfd\_ micromicrofored meg, megohin mh, millihenry and H. henry

metal panel wood base board and solder you will have nothing more to buy Two tubes of the latest dual purpose design pro

vide all the tube elements needed in any one of the six circuits provides a high frequency pentode and a high ampli fication triode The 70L7GT provides a half wave recti fier and an output pentode Both tubes have octal bases with eight pins or prongs

Before going on to the construction of the first re ceiver it will be well to review a few pointers on radio construction in gen

eral First of all use only high grade parts and make sure that they match the speci fications Second don't manhandle the parts -remember they have to last for six different circuits Third always keep your soldering iron clean and use a solder with a resin core

The first receiver in this series of six is a two tube outfit designed to operate on either alternating or direct current of 110 or 115 volts For these voltages a line cord hav

ing a built in resistance of 135 ohms is used and is the right value for all six circuits If the line voltage in your home is 120 voits a 160 ohm line cord must be

In this circuit the pentode section of the 25B8CT is used as a regenerative detector (the triode is not used) while half was e rectifier in the 70L7GT supplies the rectified current for the receiver (See next page )

PHONO AMPLIFIER . THREE-TUBE TRF . FOUR-TUBE Three holes drilled in the metal panel receive the 25 000-0min variable reasitor (used for controlling the regeneration), the 00014 mfd tuning condenser and the rotary-type switch. All other parts with the exception of the 0005 mfd, fixed mica condenser (shown mounted above the tuning condenser), are placed on the wooden baseboard.

As all the parts will be used over and over again, take care in mounting the resistors and condensers. Also when buying the parts remember that fixed resistors and condensers with "pigtails' cannot be used.

condensers with "pigtails' cannot be used.

The electrolytic condensers can have
flexible leads since they can be mounted in
the same place in each circuit, but the re-

sistors should be mounted in clips like those used for small fuses. As this is an A.C.-D.C. receiver, no ground as needed the circuit being grounded through the house lighting system Any type of antenna up to 80' in length can be used. For the reception of local stations an indoor antenna approximately 25 long will be found sufficient. It is not advisable to use e long antenna for receiving short wave signals. The finished set d agram shows the parts used Metal SOCKETS (TOP V EW)

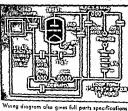
# Pocket Receiver

#### FOR SPORTS FANS

LITTLE larger than a tobacco tin, the pocket receiver pictured below is ideal for sports fans who want to hear the play-by-play broadcasts while watching a game or meet from the stands. The set employs a super-regenerative circuit, using a 958 tube that operates successfully on very low plate voltage Around the cigar box-wood case, a loop antenna is wound consisting of thirty-five turns each side of center, with both sections wound in the same direction Use No 40 DSC wire The two 140-mmf variable condensers, of the air-padder type, should be mounted with acrews before the loop is wound A brass bushing in diameter and %" long is soldered to the stub

shaft of each condens-A medium-size flash light cell serves as an "A' battery, while the 'B" is composed of four "fountain-pen" cells in The latter should last almost indefinitely as the drain is very small. Although the set is decidedly not a distance getter, since it has limited voltage and only a tiny directions! loop, it should give good results up to fifty miles on the bands between 650 and 1260 kc

You can stow this midget receiver In a cost pocket, Note the parts orrangement at the right Cigarbox wood forms the cobinet, and a loop antenna is wropped around it. while flosh light cells to power the set are carried in the



SEPTEMBER, 1940

#### Taper Waod Screws Keep Crutch Sackets Tight

ANYNE who uses crutches with scokets of the type shown knows how anneying it is when the wood shrinks and the loose sock ets clank at every step. To cure this I bought a couple of taper wood screws re moved the sockets from each crutch and drilled a hole in the end of the wood a little



deeper than the length of the screws and a trifle larger than their small ends Then I sawed two shts at right angles through the holes and as deep as the holes moved the part of the socket holding the rubber top and placed the sleeve over the end of the crutch A turn of the screw spreads the split end and holds the sleeve firmly ---A J PICOLET



### Heavy Burlop Sack Pads Edges af Hand Truck

WHEN a hand truck of the two wheel variety must be employed to move furniture baggage or any easily scratched merchand se about a warehouse cut two holes in the bottom of a heavy burlap sack and slip this over the truck as illustrated

## Linaleum Cutter Made from Putty Knife

A LIVOLEUM cutter can be made by cut ting a notch near the end of a first class putly kinfe One edge of this notch is sharp ened and the kinfe is used as shown below It has several advantages over an ordinary kinfe Circles squares and other shapes can be cut as well as straight lines after you have had a! title experience in manipulating the cutter—WAYLE R PRINCE



The altered putty kn fe and method of using it A shorp edge is necessary to cut a clean line



#### Rubber Heel Stops Brush Handle from Unscrewing

A SCHOOL faintor who was inconvenienced because the handle of his horestair noor brush often loosened and parted company with the brush cured the trouble without the use of mais or screws by the sample method shown above He tacked an ordinary rubber heel on the brush after cutting a hole through it somewhat smaller than the screw hole in the wood block. Forced into place through the rubber the handle is firm by held by friction no matter how long or vigorously the brush is welched.

# KODAK VIGILANTS

"First family" of the moderate-price camera clan...eight models

\*1450 to \*4250

FIGURES ARE NO. . . 2', x 4'11 inches with the Six-16's, 2'2 x 3'1 inches with the Six-16's, 2'2 x 3'1 inches with the Six 20's FEATURES ARE MODERN Single push batton for opening and closing Wast level and eye level view inders Retracting body slutter release Extra rigid lens support. LENSES are genuine Kodak Anastigmats And the SIUTTERS, all highly accurate and reliable, include Eastman's new nine speed Supermance.

See these finest of moderate-

price folding cameras at your Kodak dealer's Go over them "with a fine tooth comb," and you will agree that rarely has so bittle money bought so much picture taking ability

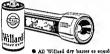
PRICES: Kodak Vigilant Six 1/, 1/8 8 lens, \$16 f/6 3 lens, \$19 50, f/4 5 lens, \$29, f/4 5 Special lens, \$42 50 Kodak Vigilant Six 20, f/8 8 lens, \$14 50, f/6 3 lens, \$17, f/4 5 lens, \$25, f/4 5 Special lens Supermane shutter (illustrated), \$37 50 Eastman Kodak Company, Rochester, N 2

GOING TO THE NEW YORK WORLD'S FAIRT.—Take your Kodah.—visit the Kodak Building.—see the Greatest Photographic Show on Earth

Only EASTMAN makes the KODAK

# Announcing Willard DRY BATTERIES and FLASHLIGHTS

New, Long lasting batteries for all purposes



or exceed U S Bureau of Stand ards specifications. Dated fresh at the factory For your flashi ches and o or other use ask for these new More for Your Money Willards.

# Safeguard Your Car against Starting failures



Most starring faifaces nee caused not by the bettery but by little things I ke worm or undersize cables loose connections or faulty wir tog that drain the life out of a perfectly good battery

Your Willard dealer has a new Starting Service instrument that X rays the entire starting system of your car-locates hidden leaks and flaws before they cause trouble A Wilard Start og Service check up takes only a few min pres and will save you many a dollar -ery id

YOUR ASSURANCE

OF QUALITY



## Small Trellis Opens to Fit Any Space

ADJUSTABLE for use in spaces up to 18 long this trellis may be placed whereever a support for climbing plants is required and bolted to posts set at either end The strips are sawed from a 1" board and are 114" by 4 Holes for the rivets must be drilled accurately so



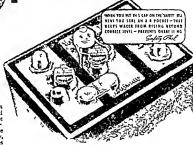
trellis will fold up compactly for storage Finished with two costs of good white paint the trellis will last for many years -B N

#### Toothbrushes Converted into Tool Hondles

WHEN the wooden handle of my drafts man's crasing knife split for the second time I replaced it with a brilliant clear red celluloid toothbrush handle. It took but a few moments to saw off the brush and drill a hole in the cut end to fit the tang of tre kune suoriy A intie velinbih inssolved m acetone was dropped into the hole and the tang pressed firmly in The idea was so successful that I have applied it to all the watchmakers files on my bench For larger tools two handles may be faced off and ce mented together with the acetone cement Marks can be removed with a file and scrap er A beautiful polish may be obtained with a buffing wheel loaded with crocus or jewel ers rouge -R B R.

Placement on Portlan Schwer Mouthly when a sig to od a POPULAR SCIENCE

# New improved Willards give you Extra advantages at NO extra cost!



#### LONGER LIFE

h, 10-15% mer mies and months
f — Forner Willards were noted
for power and long life but
nese new Willards are still better
This year, Willard engineers have
outdone themselves with a new,
greatly improved line of batteries
that give 10 to 15% longer
average life than former Willards
—and at m extra cost

#### MORE RESERVE POWER

Plate materials increased 7 9%.

—Heavier elements go into each cell of the new Willard batteries—either thicker plates, heavier plates or more plates That means nor only more life but more reserve power These new Willards easily handle the extra currend chemands of modern cars—andlikeit.

#### GUARANTEED CAPACITIES

My You know what you're getting 
—Willard has clearly and 
permaneoutly molded the 
gunranced ampere hour capacity 
to the case of each new Willard 
sturey It is in plain sight You're 
exactly what you are getting And 
you pay only for what you get. 
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#### "SAFETY-FILL" CONSTRUCTION

farlnes

Stops Dangerous Corrosion

M/No acid spray on motor and for mile surface. With Saleey Fill your Williard battery never drinks 200 much. It's very simple Very effective This exclusive new device prevents overfilling-definitely protects your automobile against corroded cables and terminals that cause current

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his red-and white Willard sign, or the name Willard in the classified section of your phooe book under 'Batteries' BATTERY COMPANY

losses and unexpected starting

Your Willard dealer has these

NEW batteries now Look for

Willard SAFETY-FILL BATTERIES

MORE BATTERY FOR YOUR MONEY!

TOMORROW'S DRIVING

"Fluid-Driving!!



#### WHY SHIFT GEARS?

Drive the new and thrilling way the Fluid Drive way It's all fun and no work. You just touch the throttle to go touch the brake to stop Fluid Drives the drive of tomorrow but you can enjoy it in a Chrysler now Tryit see your Chrysler dealer today. Your loss Pies Berner CSE Done 1841F M. F. P. S.T.



SIMPLE AS THIS!
Air from a running
fan will set an idle
fan in motion as
a breeze rusus a
windmill That's
the principle of
Fluid Deves



SMOOTH AS OR!

One faul ke wheel
drives another by
forcing a current
of oil against it.
Smooth as oil, because it it oil. No
rigid metal connec
toors Can t perk.



#### Two Authentic Signposts for Model Railways



ACTUAL signs were copied in making these model - railway accessories. The lettering is either applied directly to the signs or first drawn much

larger on a sheet of paper and then copied with a camera. For those not adept at hand lettering the second method has the ad vantage of minimizing any flaws.

Locate the crossroads signposts where roads intersect each other and the along the road type between road intersections. Holes drulled in the platform or small in squares named to the bottom of the posts will keep the signa upright. Both the signs shown in the drawings are scaled for O gauge—C ELIME BLACK

## Turning Wooden Rosettes

ROSETTES may be turned quickly on the lathe if a smooth hourd is first attached to the faceplate with a small brad projecting from it in place of a center screw Start the lathe and hold a lump of rosin against the board nyer the surface to be covered by the resettes The friction will meit the rosin Then hold the turning stock lightly in one hand set it on the brad and with the other hand press it down against the facepiate firmly but slowly In an instant the rosin will melt between the surfaces and the rosette will stick. After the rosette has been turned tap it with the handle of a chisel and it will drop off Stick on another piece of atock and repeat the process with out stopping the lathe - J J EDW ARDS



# RAILWAY EAPRESS STANDS OF THORSE OFFENOABLE DEPENOABLE SERVICE... USES DEPENOABLE

IN CITIES AND TOWNs all over the United States the familiar Railway Express truck is a symbol of dependable, speedy, safe delivery Over 12 000 of these trucks are constantly on the go regardless of Weather Dependability is the éatchward

This giant fleet has used Champion Spark Plugs for years. Here is just one more outstanding proof that Champions make every engine abetter performing engine—one more sound reason for you to insist on dependable Champion Spark Plugs for your car.

Only Champson Spark Plugs have the Silment seal which keep them permanently free from trubbe-some leakage roumnon to restrict the some leakage roumnon to restrict the seal of the some leaker in a set will some frough, uneven, wasteful to one operation, it is obviousliers are accessary to man man performance and economy Profit by the experience of the ration slargest and most efficient fleets—of the world's racing champsons on land, water and in the air—by insisting on Champsons for your car.



Champion
Spark Plugs for
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sealed Silinmante insula
for Alloy
needlepoint
electrodes for
easy startina
One pece construction

650 STEELESSE CO. EHAMPION SPARK PLUG CO. Divine Ave. Taken, Oble

V-2 V 3



# at Home with KESTER METAL MENDER

You il get a real kick out of increasing your skill as a craftsman with Kester Metal Mender You can build more things and make them better when you have a can of this handy home solder on your work bench Time and again you'll find that the easiest way to make it is to solder it!

And the same thing goes for repairing anything made of metal Kester Metal Mender contains its own flux and makes perfect money-saying repairs every time All you do is apply heat and the job's done

Buy it at your hardware or other stores For a sizable free sample of Kester Metal Mender and 'How-to-Use-It" Booklet - mail coupon now



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Dease send me Iree samp e of Keeter Metal Memic and Use-It Book et

\*\*\*\* \* \*\*\* \*\* Mail (he Coupen New \*\*\*\* \* \*\*\*

# TESTED BLUEPRINTS

# Solve Shop Problems

O MATTER what type of project you intend to build you will find that blue prints drawn to a definite scale and tested by experts will eliminate many of your For eighteen years workshop problems we have been supplying amateur craftsmen with a wide variety of plans Some of them are given below A complete list will be sent upon receipt of a self addressed stamped envelope

MODELS Brig MALEK ADUEL 20 bull from and plank or sold hull construction 4. pier Sh p in a Bott a 121 124 ROVERFION OF THE SEAS 204

Long 144 145 148 R COMCH IS tone in 147 178 21 hul 57

N 19 It sheet 1 88 1 NDIANAPOLIS 12 long 216 w Bedford Whateboat with compete equipment 14 long 328 R valeer SWALION a Relimora Cipper 13

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48 R pan an Treasute Daliron 24° long 46 4? radin. Schooner 17 6 hu 1 252 251 Ina Schooner 17 4 hu 1 252 251

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(Continued on page 208)



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75

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# but here is one worry you can avoid

If those little ruscals next door get your goat, there's not much you can do about it except change your address But you don't have to move to get Peace

Of Mind about your chassis lubrication.

Let us Marfak your car every 1 000 miles,

and be sure it is in perfect running condition.

For Marfak is Texaco's standardized 40

Point I physicition Service. Every detail is

Point Librication Service. Every detail is checked. Nothing missed.

And at every vital friction point, a special libricant goes on dury—a libricant so

tough it lasts twice as long as ordinary grease

This lubricant is Marfak, from which the full service takes its name. To keep your car in smooth as-velvet con dition, drive in and we ll do the rest.

TEASES SEALES, SEVIE VOLUME TO USE IN the TEXACO STAR THEATRE SCIENCE Renut Baker son. Francis Langing Evert Wednesday Nati-Columbia, Newtork 9 00 EDT., 8 00 EST., 8 00 CDT., 00 CST., 6 00 MLST 5 00 PST.



the full service takes us name. Texaco and other good dealers



# P. W. RESETS BATHROOM FIXTURES

You can quickly and easily reser loose bathroom fixtures, loose tiles, seal unsightly cracks around bathtubs

cracks around bathtubs and sinks with water

proof Plastic Wood At Paint, Hardware, 10¢ Stores Try it<sup>1</sup>



# DIAGIL WOOD







## Plans for the Workshop

(Continued from page 206)
Rectional Rewbort 9 8" long can be used with

Sectional Rowbost 9 8" long can be used with anall enthorid 340 341 R

Sport Runabout 9 8" lone for small outboard motor weights 100 to 310 R

TO BUILDY Rowboat 13 box on a blo be sailed or driven by edibard molor 224 R

59

FURNITURE

Cotonial Writing Deak 3 67 high
and 3 87 long 21
Combination Bench and Titt Top

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OIL for labricating rubber bearings is just mixtures seems to be one part each of alcohol and election. The alcohol evoporates and thus leaves a thin film of glycerin

The prevailing practice in drilling high speed steels based on the use of modern equipment is to ase a 135 deg point (not 118) a 7 deg clearance and a web thinned down to half its original thickness

The modern double ended end mill is the cheaper in the long run Being a two mone tool it has a low maintenance eost and a mini mam lost production cost

A certain shop which requires several motor generator units has solved a space problem by monuting the generator on top of the motor and asing a multiple V belt drive

When punches are needed in press work it is often economical to counterbore deeper so as to insert a washerlike and under each punch head If the punches ever get too short simply remove the pads

A plan milling catter is not intended to cut from the extreme ends however it can be given side catting effects for a limited depth by grounding a S deg velicf on the ends of all the seeth

Is doesn't seem possible that 96 percent cap per und unly 2 percent ivon and 2 percent coboli will produce a metal that hardens the low carbon steel Such a metal however, is now be ing made

Thanks to punch press safety devices, fewer fagers are being injured but it would till be a good idea of the sam could drop only when two buttons located about 18° opart were punched simultaneously.

The cost uf mundrels to be used in connection usth hales of precisely standard sizes can be reduced by making the tools double end to serve size different dimensions. That is of course in cases where the width of the part is not over sixes the thermal diameter.



the signal corps takes wing

What happens to army communications when bombs and shells wreek wires and nireless? The answer is pigeons . . . simple, ordinary pigeons who carry the commands of battle when all else fails, POPULAR SCIENCE ON THE SCREEN shows how the U S Army trains these winged messengers to the discipline of the old soldier Don't miss it at your theatre

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# SCIENCE on the screen

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#### Copper Wire Stiffens Lamp Gooseneck

FIXIBLE goosenecks on photo lamp stands and other lamps often become worn and can no longer held the weight of the reflector or shade in the desired position Simply insert a length of No 8 cop per wire, either bare or msulated into the neck This will add to its stiffness stiffness are considered in the control of the co

In some cases, where
the connecting wires
pass through the neck,
there may not be room
for the addition of the
stiffening wire. It will
then be necessary to
remove the lamp cord
and carry it to the
socket on the outside
—ARTHUR TRAUFFER



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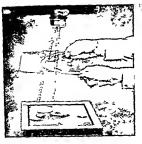
### Making Roll Film Slide Readily, into a Reel



MANY examperating moments are spent trying to load film in a roll film tank reel These can be avoided by a very simple operation. All you have to do is to crease the film lightly back on itself for about '\(\frac{1}{2}\) as shown Then unfold and thread on the

reel in the regular way. The crease offsets the natural tendency of the film to curl inward which makes the film so difficult to push along It also stiffens the film across its which cheminating any tendency to buckle The film will ginde along the spiral groove almost as though rolling on ball bearings—H S Trionview.

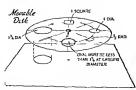
A STRING of ordinary Christmas tree lights with all red bulbs can be strung along a large darkroom not to serve instead of a satelight but to provide a guide for walking about. Each bulb must be provided with a half shade to reflect the light away from the working area \_JOIN E HELLAWELL.



# Dodging Mask Provides Variety of Shapes

With its various openings this dodging mask will be found belpful in photographic enlarging It is made of two pieces of transparent celluloid (preferably red) or other cellulose material. Large discarded photographic film if the emilion is removed with answer the purpose admirably. One piece is about 2 by 11, the other about own applied to the property of the prop

The 8° square piece is then cut into a circle and openings are cut out with a razor blade as indicated One large round opening is cut in the main make. The two parts are assembled with a paper fastener so that any desired opening has be revolved into position over the circular opening in the rectangular mak.—FixAN CAPOREAL.



Transparent red or red covered celluloid is used for cutting out the two parts of the dadging mask

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of Par of Reby Box 15 try See e. d on pite ad it of a good of Mod A peer Race



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# How to File Negatives with Phato Data Cards

AMATURE photographers who are using the site card system personsity described in this department (PSM Feb 40 p 168) can keep the negative of a photograph on the same card with the remainder of the data provided the negative is smaller than the method of mounting the contact print on the back of the file card Instead of being pasted on it is fastened with strips of masking tape slong two opposite edges. The negative is then slipped between the print and the card where it remains as if in and the card where it remains as if in and the card where it remains as if in any the control of the card of the card of the card where it remains as if in an executed but saves considerable time in the darkroom—TIONUSE F CONTONES.

#### Tray Catches Developer Spilled fram Tank

WHEN developing the largest size film a tank will accommodate it is necessity to fill the tank as full as possible. Occasionally developer spills over the edge of the tank and is lost. If however, the tank is set in a clean tray the excess developer may be recovered—W W. LININ.



## Field Trials for Doas

(Continued from page 75)

the factors which control scenting condi tions He constructed huge metal funnels containing delicate splder web diaphragms Sunk in the ground they proved that the earth literally breathes air passing out of the ground when it is warmer than the surrounding atmosphere and into the ground when it is cooler than the air Thus scenting conditions are best when the earth is warmer than the air

Near the spot where the Chuton course swings south along the stream one of the pointers locates the first bird. It freezes The judges note its pointing Both head and tail should be held above the line of the back. Then its trainer moves in raises a pistol and fires a blank cartridge over the back of the pointing dog Every animal entered in the meet must pass this test to prove it is not gun shy

As soon as they break out of the woods the two pointers rush this way and that among the bushes and planted patches of grain. Fach animal has its individual manner of covering an area. The pattern made by its zigzagging course is carefully noted by the two judges If a dog bolts straight through an area or circles it without thorough investigation it is penalized

Spectators on the hillside watch the dogs intently From the let em go1 of the break away to the Take em up! of the fin ish a field trial is often anip and tuck strug gle and the minutes in the meadow are among the most vital in the contest Time after time the dogs stiffen scenting the pheasants which have just been released or others previously let loose The judges have their watches out The contest has narrowed down to seconds. Then one of the pointers husnes a bird and breaks after it, chasing it half across the field in spite of the owner's frantic blasts on the whistle That blunder gives the higher score to its more steady bracemate

A few minutes later while these two pointers are being carefully rubbed down, another pair begins the circuit of the course So the contest continues hour after hour There are exciting upsets stirring exhibitions of training and skill And finally at the green trailer which forms the temporary headquarters of the club solid silver plates are awarded to the winners These animais the product of scientific breeding and training have demonstrated the great est degree of speed scenting ability and stamina-the three outstanding requisites of the field trial champion

# SECRETARIES SURE COME SMART THESE DAYS



his lange not I is secretary It's I to wife She's admiring that smooth, fresh feeling Barbasol

Lace his secretary t ld lum to get No harsh pretants in molern Barbasol to drs, tighten, coar-en tie ekin Only Han Lingredients that coutle the skin as well as soften the beard fry Barles of and are what won lers it works with your face in ten short days or so.

YOU RE RIGHT. He does have tender skin but shaves with Barbasul-unth pleasure! Here's the secret! Barbasul is modern Soothing, cooling cream that it is, Barbasol dies the job of ol I fashione I prej arati ins without rais



No Lather - No Rub-In



#### Can We Defend Our Caasts?

(Continued from page 97)

their anchors and control wires stored and the mines laid at the outbreak of war Con tact mines are used to block off the parts of harbor entrances which need not be used by friendly ships Controlled mines are used to guard entrances which must be used by friendly shipping and which are within range of the harbor defense guns and searchlights which protect the fields against sweeping The electrical control apparatus may be set so that a mine will explode the instant that a ship comes in contact with it or so that the mine will signal that it has been struck and then will explode after any desired number of seconds-a method which makes it fairly certain that the mine will explode while it is in contact with the bottom of the ship Until its firing switch is closed a controlled mine is barmless

During the peaceful years that followed the end of the World War the Coast Artil lery like the rest of the Army suffered from the starvation diet imposed on it by inadequate appropriations Our coast de fense system which had been one of the world's best was allowed to go downhill In 1936 Increased appropriations made it possible for the Coast Artillery to start im proving our Panama Canal and Hawanan defenses Our Pacific Coast harbor defenses also were improved. But until about a year ago our Atlantic and Pacific seacoast de fenses were in a decidedly unsatisfactory condition Since then ateady progress has been made in improving them Some fortl fications have been modernized an undis closed number of new guns have been mounted and the defenses against attack from the air have been tremendously in creased But we haven t gone nearly far enough We need more guns and we need more highly trained coast artiflerymen to

handle them

\*\*Marbor decleases can't be improvised in an
emergency. It takes close to three years to
bond a battery of heavy guns. Strong harbond a battery of heavy guns. Strong harfrom the sea because the loss in irreplace
sable shaps would be too heavy. Weak harbor defenses guarding important ports and
cities are an almost irresubble temptation
to an enemy fiest especially at the begin
never have to fire a short their cost willaw
a very low priced insurance premium for
the protection they give

# Flyers by the Ten Thousand

(Continued from page 49)

iegians Only one scholarship winner in each course may be a woman Those who accept scholarships must pay an additional fee of twenty dollars to cover the cost of physical examination and required insurance

About 7000 students started the ground courses early in January of this year and cover 700 winners of CAA and privately offered scholarships together with non winners who are paying their own flight instruction costs of shout \$300 now are receiving flying instruction. It is expected that by the end of August nearly all othern will have completed their courses and received licenses.

Women college students showed as keen interest as the men did when the courses were announced last year Forty students in four women's colleges were accepted and 324 girls in coeducational institutions A large proportion of them made the grade although the percentage of those who failed to win licenses was aimost twice as large as that of men Ground course in structors told me that the girls usually had to work harder than the men because they weren't so strong in mathematics One flying teacher sald that although all four of the girls in his classes got through all right they were considerably more nervous than men and a little slower to learn

The ground course which consists of seventy two one hour lectures instructs the students thoroughly in the history of avia tion flight theory the CAA regulations air navigation meteorology the use of parachutes the aircraft power plant instruments and radio To go on to the flight course the student must pass an examination with a mulmum mark of seventy in each subject.

The flying course is given by a C.A.A approved operator who must provide one instruction plane for each fifteen students at an airport con venient to the college. It is divided into three stages—a minimum of eight hours of dual instruction a minimum of three hours of preliminary soli flying with one hour of beek flight and a minimum of fifteen hours of advanced solo work with eight hours of dual instructions as a check

CAA instructors devote the first flying lessons which are given on the ground to making the students feel at home in the plane and to simple explanations of the con trois and instruments. All instructors agree that nervous and muscular tension is the

(Continued on page 220)





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# Flyers by the Ten Thousand

(Continued from page 219)

most deadly enemy of good flying They are alert for indications that the student is choking the stick -- getting a drowning man's clutch on the control This prevents the development of the delicate feel by which good pilots fly During early dual flights the instructor, in

the front seat demonstrates simple maneuvers and the student follows his movements on the dual controls Then the student is al lowed to fly the plane except when taking off and landing with the instructor ready to take over if be makes a serious mistake In the later lessons of the dual instruction stage the instructor demonstrates spins and simulated forced landings and the student is permitted to make into wind take offs, and into wind landings without power As soon after the minimum eight hours

of dual instruction as the teacher thinks he is competent the student makes his first solo flight. He devotes at least six half hour periods with as much dual check instruction as bia instructor thinks desirable to practicing level flight turns glides and other elementary maneuvers. Then he goes on to advanced solo flight and devotes fifteen hours in the air, checked by eight hours of dual instruction, to precision isndinga stalls and spins power turns, cross-wind take offs and landings with power, and oth er advanced maneuvera leading up to a fifty mile cross country solo flight over a triangular course and finally to the examination for his private pilot license

The Civil Aeronautics Authority a pilottraining program has been sensationally successful in training a large number of pilots with a hitherto unknown degree of safety It is expected that during this coming year at least 600 colleges will offer CAA courses to their undergraduates and that there will be a proportionate increase in the number of noncollege courses Many of this springs graduates intend to enter Army or Navy flying schools after they have completed their advanced courses this aummer.

Already the program has helped material. ly to increase the number of licensed pilots in the United States from 33 000 to 45,000 in less than a year Aviation experts are confident that the expanded program will provide a large number of well grounded candidates for commissions in our naval and military air services and that many of its graduates will become pilots of the new fighting planes on which some day the safe ty of America may depend

#### Is It Murder?

(Continued from page 71)

with pen pencil por typewriter. It was the impression left on a sheet of tablet paper when according to the husband the original had been produced on the woman's death bed. He declared he had never been shie to find the will itself but had discovered the tablet with the impression writing on it after his wife a death John F Tyrrell noted Mil waukee authority on questioned documents was called in to examine the ghost writing His ingenuity in proving it could not have been produced by the dying woman stands as a classic example of the resourcefulness of the modern scientific sleuth

Examining the tablet closely Tyrrell found that the impression was faintly visi ble down to the fifth sheet Yet when he studied the ordinary bandwriting of the dead woman he noted that she used an ex tremely light touch. The night before his appearance in court Tyrrell set to work with a piece of wire a tin funnel and a pen cil First he mounted the pencil point downward in the bottom of the funnel Then he made a loop in one end of the wire and slipped the funnel into it With this simple apparatus and a bag of lead shot he appeared in court the next day

Pouring shot into the funnel a little at a time he pulled the weighted pencil along the tablet with a piece of string at the same

time using the wire loop to keep the funnel upright without removing any of the load from the pencil point. Three ounces of shot proved sufficient to produce a line compar able to that found in the known writing of the dead woman But three additional pounds had to be poured into the funnel before the pressure was great enough to carry the impression down to the fifth sheet of the tablet In other words the phantom document supposedly written by the dying woman would have required sixteen times more pressure than she used in normal writing when in full possession of her health and strength

The absurdity of that story was graph scally disclosed by Tyrrell's simple demon stration Convicted of forging the note and of poisoning his wife the husband died in the penitentiary Like scores of other per fect crime killers who have sought to pass off murders as suicides he overlooked one thing-the skill and resourcefulness of the science using detective employing all the new discoveries of the laboratory as weapons against the arch criminal the cold blooded murderer who plots m advance to escape the consequences of his crime



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# Grooming the Iron Cavalry

(Cont nued f om page 101)

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the Mechanical Br gade

Accompany ng the fight ng webicles is the rathe—by fructor trucks loaded with drums of great need a minutal on and food trucks which are fast moving mach ne shops mobile is tepens which cook as they roll. When he full by rade !s marching on a single road its column stretches twenty miles from head to tal.

Ahead of and above the dust atreaked gray green combat vehicles and trucks by gray green combat vehicles and trucks by the planea of the observation squadron in war the r most important in as on would be to obta a and report informat on about the enemy. On peacet im sumerhe the r main job is to watch the long column for gaps and the state of the contract of the co

In an all motor zed all mechanized force equipped with close to 800 veh cless many of them of except onelly complicated character maintenance becomes a major problem

When the brigade is on the move each troop is followed by its ma ptenance truck whose erew makes any roads de repars if can handle. Reg mental ma ntenance trucks follow each regiment and their crews take care of more serious breakdowns. At the ta l of the column roll the trucks of the ordnance ma ntenance company-trucks loaded with spare parts and even spare engines ma chine abop trucks a generator truck which prov des electr e I ghts for the field machine shop which is set up each evening in a be square tent Wreckers tow d sabled vehicles to the night s blvouge and the rule is that the cripples must be ready to roll when the brigade marches in the morn ng march last year the maintenance companies handled eleven major repair jobs in one night putting in 263 man labor hours doing it At the end of the 700 m le trek the brigade had all but two of its combat cars and all its other vehicles except one halftrack in condition to take part in a strennous tactical exercise

Thirty five miles is a fuil day a march for horse cavalry Fifty miles is a forced march Returning from a Civil War raid into Penasylvania Jeb Stuart's Confederate troopers won lasting fame by riding from Chambers burg to Whites Ford on the Potomac eighty four miles in twenty four hours—one of the great cavalry marches of history

A hundred and fifty miles is a normal day's murch for the Mechanized Brigade Marching from Fort Knox to Flattsburg fast summer it did 1000 miles in ask days on one occasion it marched 320 miles in a little over twenty four hours. These marches werent made under war conditions of course but the iron cavalry moves fast—and it can hit hard when it gets there

The younger soldlers of the Mechanized Brigade have served only in the Iron cavalry They were attracted to it through their in terest in automobile mechanics and by the fact that it is something brand new The brigade has no difficulty in filling its ranks with high-grade recruits.

Nearly all the officers and many of the noncommissioned officers are former horse cavalrymen Some of them I talked with ad mitted that they missed the horses but all of them were keenly interested in their new jobs An old top sergeant with a lot of service stripes on his alceve said you first come to the Mechanized Brigade from a horse regiment everything seems strange to you And then you begin to realize that after all the Mechanized Bri gade isn't so very different from any other cavalry outfit-that you re really doing the same things for the same reasons only you're doing them in new ways Cavalry is cavalry whether you're riding a horse or driving a hell buggy

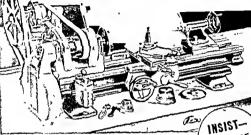
# POPULAR SCIENCE Question Bee

THESE are the correct answers to the Question Bee on page 116 Give yourself five points for each one you had right A total score of 75 to 85 is good 90 or better is excellent

Į	ď	6	No	11	Mole	16	Fauna
:	c	7	No	12	Plane		Tackle
,	a	8	Yes	13	Jack		Longitud
ı	b	9	No	14	Root		Strain
5	c	10	Yes	15	Ton		Tria.



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The tin washtub, for instance It did duty Monday mornings and Saturday inglits, and the water was heated in the reservoir at the hack of the woodburning range Spitting the wood was good exercise—but it was no fun to get up in the middle of cold nights to keep the fire going. And the feeble kerosene lamps, though an improvement over candles, had to be continually filled. Sometimes we have to "rough it" to realize the improvements time has brought—many of them through electricity Not only electric lights, and electric apphances to mule housekeeping easier, but also automobiles, better roads, better coats and dresses

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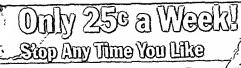
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# ONE MORE STEP —





"THE WIND HOWLED and the darkness seemed to increase as I arrived at the quarry where I was to do a welding job on a big steam shovel writes Mr Emmons."

The rain streamed down in slanting torrents

IN THAT DRIVING STORM I had to move slowly about, walk ing with my back to the wind and tug ging at my heavy gear Then suddenly I had a horrible sick ening sensation of danger





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#### WOODWORKING

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## Our Readers Don't All Speak at Once-

## Just Raise Your Hands

WHILE attending a movie about a month ago I saw someth ng that I would like your mental wizards to explain It was one of those western films where the stagecoach ran away in the usual manner While I was sit

BEEN DON THAT EVER FRST MOV E 50N

ting there waiting for the hero to catch the runaway a strange sight caught my eye the stage coach wheels were running backward Everythlue in the picture was moving in the right direction except the wheels I have noticed ever in western Since movies that these

wheels always run backward Another quest thing is that when the wagon or stagecoach is stopping the wheels suddenly raverse and run in the r gbt d rection without any apparent reason I would like some one to explain this phenomenon It bothers me every time I go to the movies -G B Riffle W Vs

#### When a Ship Sinks, It's Sunk, Seems To Be the Answer

IN ANSWER to A. G. of New York City I believs a sinking ship goes straight to the bottom Its rate of descent would depend upon how it went down-bow first or other

wise As to the ship remaining suspended at a certain depth this is a popular miscon ception Its specific gravity would then have to be exactly one Naval experts have been trying to achieve that in submarines for a long time without success I doubt if It could ever happen by chance —C S North Tarrytown N Y



#### He Likes the New Arrangement of Our Editorial Pages

It over me great pleasure to commend you on your new editorial arrangement You aiso deserve much praise for your constant efforts to improve the magazine and keep it the most valuable magazine on the market, as it has always been in the past-E. B. I aterson N J

#### He'd Still Keep the Army Mule for Its Educational Value

This plan to mechanize our Army is all right will me if the generals think it is the thing to do though well surely miss the horses But what about that educational in stitution the army mule? Motor trucks may be able to go faster and haul more but they can't compete with mules in giving men a fluent command of language. There's something about associat

ing with mules that enlarges the vocabu lary I have heard old time mulc skinners who could teach Noah Webster some words he never got in his book You can cuss a motor truck too of course (and some do) but mules seem to bring out everything a man has in him Mech anize all you want but



keep a few mules to talk to Otherwise there will be a great decline in the fine art of name-calling-M J Louisville Ky

#### Putting a Speedometer on the Moving Shadow

THE problem of the rate of the moving shadow in the August lesus was excellent for brushing up on college calculus. The shadow was moving at the rate of four and \*four forty ninthe miles an hour (or approx) malely 4 082) at the required instant—that is if my involved calculations are correct -R G A Brooklyn N Y

#### Now All We Need Is

a Perisphere WRILE resting my dogs after an all-day tour of the New York World a Fair I want to write a belated letter of appreciation to the editor of my favorite magazine Going through the scientific and industrial displays at the exposition grounds I realized as never before how thoroughly PSM has kept me posted on new developments in all fields of research There was not an exhibit that I saw today which was not made more inter esting and understandable to me by my read ing of your pages I realized that you have been doing in words photographs and draw ings just what the exhibits do In short PSM is a world a fair in itself-and a little (Continued on page 14)



1 Ann doesn't cry easily-but that night I found her in tears! 'I can t help it," she sobbed "All the things we were going to do-buy a car, build a home-remember? And here we are-married three years and just barely making ends meet! I thought our dreams might come true-but it's no use" I made up my mind right then to "have it out" with the boss



2 "Look herel" he said "I can't pay you more unless you're worth more! And frankly, John, you lack the training a bigger job needs Ever hear of the International Correspondence Schools?"



3 When I learned the boss was a former ICS student. I signed up quick! And a hat a difference it made in my work! I'd never realized until then how little I knew about the business



4 I'm happy, and Ann's happy, and I guess the boss is happy, (At least I've had two "raises" in the last year!) And here's the very same coupon that I mailed, staring you in the facel

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## Our Readers Say CONTINUED

easier on the feet. Why don't you call it A World's Fair in an easy chair 7-T J J., White Plains N Y

#### Doughnut Dunker's Bad Example Proves To Be a Good Problem

THE math minded boys have been enterta ning me for several years through the medium of Our Readers Say so I shall reciprocate by giving



them a 1 ttle food for thought A man was getting ready to dunk a doughnut in his milk He had a bemispherical bowl of six inch dlameter containing seven culls of milk and a nice fal doughnul of fourinch outside dlameter with a one inch-di ameter hole By ac cident he dropped

the doughnut which floated horizontally haif submerged in the milk How much milk did the dunker have to mop up off the table? -(Miss) H M S Baltimore Md

#### Readers Get Together on Sigmese Twin Bike

IN Your August Issue you have a picture of a three wheeled tandem bucycle made by attaching the front fork of one bike to the rear axle of another Thie is old sluff I made one with a friend more than three years ago It lant as rosy as you have it

though In the first place you have to ruin some ones front fork by enlarging the holes to go over the axle of the other bike and also it must be spread an unusual amount because of the length of the rear axle Second ly you cannot prevent a torque effect in the middle and the riders must do a hula to keen the bike going All in



all it isn't bad especially if your bike is used for the land - Y. M., Immedown N. T.

Wirst my cousin I have used this method of cycling for some time and beartlly recom mend it for long-distance travel By luning our bicycles up we are able to reach speeds approaching fifty miles an hour a speed of twenty miles an hour can be held for some distance without tiring the riders. There are however certain difficulties encountered

in this arrangement. In starting until practice has been had an unpleasant swinging is given to the rear man sometimes enough to throw him off On corners the rear man should stop pedaling and give all his atten tion to batancing The sharpest turn possible is about a ten foot circle and the bicycles will lock in the turn unless the front man has strong wrists and arms On sharp turns the rear bicycle leans the wrong way I have been thrown at least twenty times when turn ing around in the middle of a street. In spite of these difficulties however the ease of travel for distances or bill climb amply re pays the riders -W G Winnipeg Canada

#### Whatever Became of the Nicaragua Canal?

Tear was an interesting and timely article on Enlarging the Panama Canal Certainty our Bg Ditch needs every possible protection But why not put through a second canel in Nicaragua? As I remamber it the Nicaragua site was considered long before the U S took over the French project at Panama In 1888 I ba

YOU CAN BUILD EXTRA LOCKS FASTER THAN A WHOLE NEW CANAL! Nicaragua route was made by a party of U S Navy engineers under R E Peary later discoverer of lha North Pole Their report was so favorable that lhe canal was nearly built there in

the first place More recent surveys by Army engineers have confirmed the feasible-

heve a survey of the

ness of the plan. With two entirely separate canals it would be some job for an enemy to boltle up our fleet in one ocean Thera is another advantage in this plan with two separate canals there would be two different sea approaches. That would make it harder for an enemy to cut off our naval and merchant ships by mines or blockade -E S T. Washington D C

#### Well, It Has as Good a Ring as Some Plans We've Heard

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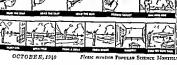
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## Doctor Prescribes P S M —"As Good as Medicine"

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ray recuperate and slowly regain her eyesight happy in knowing that medical science and aurgery have saved her from blindness But we have not mlased an issue of Portlak Straves You see women like Port Lak Straves as much as men so I read each tasue to her. The effect in the strave of the property of the strave of the str

on her mental cond: tion in aiding recovery of vision was worth the magazines weight in gold to us Which leads me to tell you that your staff little realize as you send Porulas Science on its way throughout the world the great amount of happiness and contentment it carries into homes. The read ng of its pages to my wife brought a change and contentment to her when life seemed darkest and those printed words helped greatly in leading to her re-covery Our doctors when told of the com-fort she received from hearing it read to her eard Don't miss an issue Read it to her Its as good as our medicine now because she needs rest and quiet nerves It will greatly help her on the road to recovery So I am deeply indebted to you your staff and the most welcome magazine,-R. R R., Bitely Mich

## Why Not Use a Catalyst as a Diesel Spark Plug?

This is a question from a layman who maybe neight to know the answer but doesn't Why can't designers and manufacturers of Desel engines take a cue front the acetylene wilder who lights in a forch with a minute wilder who lights in a forch with a minute of the control of the committee of the control of the committee of a Diesel engins? If Diesel-engine fuel is a hydrocarbon and if acetylene is a related substance what reason is there that related substance what reason is there that need to come the committee of the committee of

## Yau Can't Blame the Inventars

These was an Irone note in your With the Inventors last month in the first item you isted the airplane as one of the great American inventions. Then just below that a part of the wind in the wind would make of their strictly example almost every invention you can isme has been prostituted to the purposes of destruction. An inventor never knows whether he is making its better for Det Schot whether whether was the wind in th

## Daes Friction Upset Electrical Balance of Conductors, Too?

ONE of your readers saked why a static electrical charge appeared on glass and other nonconducting materi interest of ALL THAT, as when rubbed I wonder if it could not



be that such charges also appear on metal but the metal being a conductor disalpates at them? It seems to me that most any substants is capeble of having some of the electrical balance destroyed by friction—

R. S. Pasadene Calif.

## It's All Right If You Don't

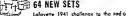
Take a rubber balloon with writing on it or draw asmething on a plain one. Blow it up. The writing or the drawing is enlarged. Well why not make maps plans and other things on sheet rubber? The sheets could have corner pieces with holes for thumb

tacks. Then all you di have to do is stretch out the sheets tack them down and draw on the auxface. Stretched to the same tension they could be used any time. Take out the tacks and your plans shrink for easier filled carrying and so forth You can fold them crumble them in your hand drop em in

OM WELL THE WORLD IS BOOM NO UP ANYWAY I

the lake but you can't hurt your plans Will some one let me know if it works I never tried it -D W Whippany N J





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## With the Inventors

WITH Halloween just around the corner an odd false face developed by Goorge L. Edwards of Fuquay Springs, N. C. should prove of interest to thousands of prospective revelers Made of thin rubberized material, the comic mask is provided



with air pockets or pouches at the nose, cheeks and ears into which air can be blown by an inflating tube held in the mouth of the mask weare. Thus the ears nose, or checks of the mask can be puffed up into luderous forms that change their shape as the mask wearer inflates or definites the pouches. The false face is attached to the bead by means of head straps, and also by loops that are stretched around the ears... earlier the stretched from the control of the stretched from the stretched around the ears... earlier pantled on the same day to one inventor. Sidney flusher, of New York City Practically all of them relate to methods of stabilizing various foods or food compounds.



KREBS, of Ja-maica, N Y, is credited with the design of the handy beverage mixer shown in the illustration powered by two dry cells contamed in a flashlight battery case, the unit has mixing blades mounted at the end of a shaft designed to go down into a tall drunking glass

. WALTER

to the battery case of the diminutive mixer makes it easy to hold the unit upright while it is in use... COOCESS has passed and the President has signed a bill authorizing the Commissioner of Patents to keep secret all patents relating to national defense The legislation also gives the U S Army and Navy immediate access to all war inventions on which patents are now pending or on which patent applications will be made...

BECALSE be recog muzed that the ordinary smokers pipe is an awkward object to carry in a pocket, and because he felt that the average smoker likes variety in the shape of his pipes Robert S Blair, of Stamford Conn . worked out a novel pipe that has a flexible stem Made of strips of metal twisted spirally into tubular shape, the stem ean be bent back



ean be one of once as over the bood, thus formung a compact unit that it easy to carry. The stem may also be twisted to any desired shape to give the smoker a straight or curved stem pipe. Within the stem tubing a flexible sondnessed sixty consistency of bristles fastened to a twisted wire center, fifters the smoke as it passes through or the standard of the stand



ritte muser invention of Albert Philquist and Arvid Larright while as of East Hempstead N Y From a passed and small oil reservoir built into the wooden saw authorizing handle a discharge tube leads to nozzles (Continued on page 22)

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#### With the Inventors

(Continued from page 22)

mounts from step to step As iliustrated one foot will use the regular stair treads TO MAKE and the other the auxiliaries IT POSSIBLE to parachute heavy loads such as weapons am



munition, and other military sup plies from airplanes to forces on the ground Fran cis McCarroll a Lakehurst N J inventor, suggests tandem parachutes This ar rangement, claims would float heavy objects to earth slowly and with little chance of the load oscil lating or swinging back and forth as it descends and hita

the ground In his invention the load to be dropped would be stowed in a bag or basket attached to a series of three or more main chutes which would open out one after the other from a container in which they are packed The container would be attached to several pilot chutes whose chief function would be to open the main load bearing parachutes FOR NOTING CHANGES in temperature or as a guide in maintaining

a desired amount of heat or cold in temperature - con trolled rooms thermometer invented by Stanton L. Lane of Fuguay Springs N C Is equipped with a sliding pointer Set at any level it ahows at a glance whether the tem perature is above or below that point. Since the pointer is colored to match the liquid in the thermometer tube

it is easy to read

It at a distance MORE PLANT PATENTS are held by Dr Ralph H McKee of New York City than by any other individual His total of patents in this classification is fourteen, all for hybrid poplar trees



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Diff you ever try to maneuver yourself into position to push a doorbell button when your arms were full of packages? The contortions required to accomplish that trick are not nec essary when novel push bars are in stalled to replace the bell but tons at doorways. Designed to enable delivery boys or heavily laden guests to ring the bell with their elbows, the bars are made so that pres-

sure at any point along their length makes a positive contact, closing the circuit and ringing the bell. The push bers are available in two sizes and four finishes, and can be installed on any door as easily as a conventional push button.



It's easy to ring the doorbell with a load of packages

## Extension Lamp Lights Lawn or Garden



Laws lamp in use An ad ustable clamp holds at on any support a the tempo ary or permanent

For home owners who want to illuminate their lawns or gardens at night, an extension lamp just placed on the market should answer the pur pose. The unit consists of a porcelain socket that will accommodate a 100 or 150-watt bulb, an all metal aluminum finished reflector and an ad justable bracket that permits the lighting device to be installed in a permanent location, or to be attached temporarily to a post, pole or other upright. An extension cord connects the lamp unit with an electric outlet within the house.

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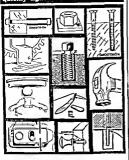
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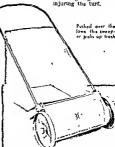


## Garden Spray Outfit

EVERYTHING necessary for controlling any insect pest or plant disease that may attack vegetable or flower gardens is said to be included in a garden spray kit just offered Packed in a green-finished metal box provided with a lock and a carrying handle, the outfit includes a spray gun and a dueting gus together with supplies of lead arsenate, picoline sulphate dusting culphur, and rotenone dust A chart giving directions for using the various spraye is provided.

## Sweeper Cleans Lawns

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The man, a well-known explorer and geog-rapher tells how he found these strange meth ode in far-off and mysterious Tibet, often called the land of miracles by the few travelers permitted to visit it He discloses how he learned rare wisdom and long hidden practices closely guarded for three thousand years by the eages, which enabled many to perform amazing feats. He maintains that these immense powers are latent in all of us, and that methods for using them are now simplified so that they can be used by almost any person with ordinary intelligence

ited by a one-man power-mind, has within him the mind-power of a thousand men or more as well as the energy-power of the universe which can be used in his daily affairs. He states that this sieeping giant of mind-power, when awak-ened car make man cepable of surprising ac compilshments from the prolonging of youth to euccess in many fields. To that eternal question,
'Do we have to die?' his answer is a tounding

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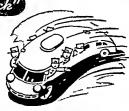
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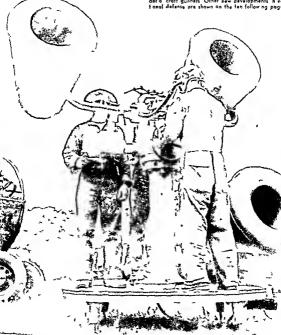
ROLLING'S A SIGHT FASTER WITH PRINCE ALBERT, TOO. NEATEST, FIRMEST MAKIN'S' SMOKES BY LONG SHO

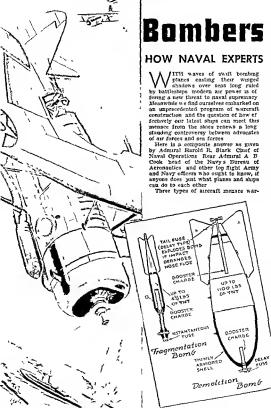
pipefuls of fragrent tabacco in every hardy tin of Prince Albert

### POPULAR SCIENCE Montalu

### NEW EARS LISTEN FOR ENEMY PLANES

A new type sound detector for locating approaching a call being leasted by the US. Army of excent manners. It is client descent for the property of the proper





## or Battleships?

### ANSWER A VITAL QUESTION ON DEFENSE

ships each in a specialized way—horizontal hombers dive hombers and torpedo planes

And each has its advantages and drawbacks. Horizontal bombers attack their targets from relatively high altitudes aiming their missiles with a precision bomb sight. The size of these large multiple engine craft gives them great crusing radius and bomb carrying capacity. Flying miles high makes them comparatively safe from a warship s antiaircraft free.

But all is not on the side of the bomber screw by any means. For safety in allitude they pay in loss of bombing accuracy Viewed from 5000 or 1000 feet even be biggest warship makes a pretty small grap speck upon tobe blue occan. If they describe to improve their chances of bitting it their own chances of getting hit by its five-inch anhaircraft guns rise in exactly the same proportion.

And here is a little known fact. More than balf the time clouds over the ocean prohibit bombing from above 10 000 feet. For days on end unfavor

able weather may keep the ceiling much lower

Even worse a borizontal bomber suffers from one incurable weakness owing to its method of bomb sight ang Just before dropping abomb fors period variously estimated from fifteen seconds to more than a minute it must maintain an abso

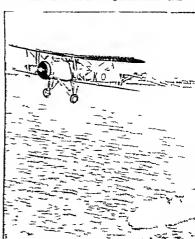
By ALDEN P. ARMAGNAC

Drawing shows the two principal types of bombs used against wanth ps. Fragmenta to bomb [at left] shorters into peess their wreak hover a mong exposed per wreak hover a mong exposed per sonnel demolt on bombs a designed for structural damage to ship in photo at right o low firing plane drops a forpedo

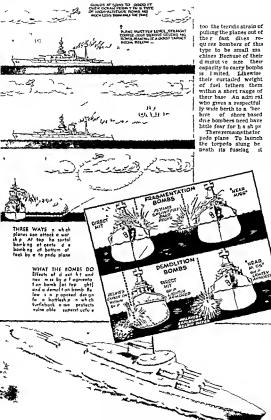
lutely fixed course and speed This delights antisurcraft gunners

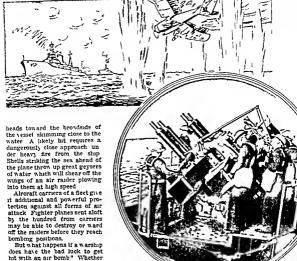
Due bombers use entirely different tactics. Power diving almost vertically upon their larget at more than 400 miles an hour they release bombs at such low altitudes that the projectifies can scarcely miss. In this type of bombing there need be no elaborate corrections for altitude wind and the speed and direction of the target. Only the simplest sort of sight need be used the pilot virtually aims the bomb by aiming the plane. A favorite stratagem is to dive out of the sum so that its glare blinds gun ners below.

But the dive bombers very style of at tack means flying down the barriels of all the autiaircraft ordinance that can be trained upon them They run the gantlet not only of the big hand loaded guns but also of the shorter range multiple pompons or machine channon that throw a continuous bail of small explosive shells much as a machine gun firer buillets. Then



OCTOBER 1940





A mult ple pom pom in act on. Above geysers of water from shel fire wreck a torpedo plane

But what happens if a warship does have the bad luck to get hit with an air bomb? Whether minor damage results or Davy Jones a locker receives a newcomer depends both upon the

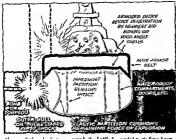
type of bomb used and the class of ship Fragmentation bombs inflict casualties among exposed personnel Fused to explode instantaneously they hurl deadly fragments of steel in all directions. If they miss a ship and hit the water near by they still det onate in time to rake the deck with their spiniers. Because of their light weight thirty pounds or less—sirplanes can carry large quantities of them. For the same reason they effect little or no structural damage upon a ship

Demolition bombs on the contrary, are all that the name implies They range in weight from fifth to 2000 pounds. Often they are fitted with delay action fusers so that they burst after peatrating the target or the surface of the water. So adapted a bomh of this type acts in the same way as a depth charge to destroy a time skinned submanum. Spotted from the air while it

is submerged, an undersea craft is helpless to fire back or, because of its limited speed to maneuver to dodge bombs. At the surface, it is almost as vulnerable. In fact, reports indicate that air bombers are almost as effective antisubmarine weapons as the sub chasers of the last war.

Destroyers and other small warcraft, too, can be sent to the bottom by a direct hit from a heavy demolition bomb. Their protection lies in their limited size as targets and their ability to throw off a bomber s

aim by fast, zigzag maneuvering Bigger ships though better targets bave more in their favor. Even an amateur mathematician will realize that, when you add



Mass ve dack and side armor guards the battleships vistal parts from harm

to a ship same the deck area increases only as the square while the displacement—and therefore the weight of armor that can be carned—increases as the cube This ex plains why great battleships can be armored far more effectively than smaller craft against site hombs

Massive horizonfal decis of armor plate placed as hear as possible to the water his to conserve stability supplement the 'bett' or side armor of modern captual ships Originally intended to protect the magazine and other vital parts deep in the hull from high-angle shellifer this deck armor now serves the edded supress of wardings of eir bomba in the pewly launched 25 000 ton U S batterings Washington and North Carolina; the children of the contract power of

Special demolition bombs could be built that would pentrate deck armor, but their tremendous weight of steel would allow only a small Explosive charge. For gravity to give the bombs sufficient velocity to pleace the armor planes would have to Josec them to a salitude corresponding to the 10 000 from an altitude corresponding to the 10 000 from thigh trajectory of shelin sized from guna reducing the chances of a direct hit. And nothing his would do, for an armorable would not be sufficiently and dropping for the water near a ship of an armorable carry too filtre explosive to harm 1).

In contrast a standard thin skinned dembition bomb acts like a mine if it explodes under water alougside a vessel Multiple, water tight compartments are the battleship's defense against such a "near miss" and a damage-control crew springs into action to stop leaks pump out flooded compartments, and restore the ship to an even keel

How to protect a big ships superstructure against direct hits by demolition bombs which may cripple if not sink remains a major problem confronting the world's admiralties One solution proposed by naval architects envisions warships of the future completely covered with turtleback armor, with virtually all the upper works removed and only the muzzles of big guns

probleming from the carapace of steel Whatever form at many eventually take, however, the majestic battleship remains the most invulsarable of all surface craft—as has been proved in actual bombing experiments upon old, strapped, and take controlled U S bottom by shellfire after repeated bomb explosions falled to smik it.

And now, how do all the factors of air power versus sea power aid up? Evdently the bainne is close-unless the goalea are tipped violently, one way or the other, by the particular mission of the sea or air forces

If shore based bombers enhank on a longdistance raid against an enough feet fuel bad will benk their bomb opporty. Lack of easort places, incapable of riying so far will leave them open to attack by defending planes, as well as by antiditeralt fire Loss of valuable bombers is likely to outweigh the inhitary value of any demage they might do

CONVERSELY, an adment would be courting diseaser by using his fleet to force a landing, or cover an evacuation of teories within easy range of a powerful energy are base Only an emergency would justify the hazard it as a comforting thought that an invader a fleet would face the same warm reception from our own army a flying-fortness bomber.

But this country's grand stategy differs as much from that of Europe as the vast oceans that lap our shores contrast with land locked European waters For our defense, we picture (Continued on page 223)

### Uncle Sam Vacuum-Packs His Gas Masks



O KEEP them in first class condition for periods as long as thirty years gas masks being manufactured at the U S arsenal at Edgewood Md are sealed in special vacuum containers. After the masks have been as sembled and tested they are placed in cor rugated metal containers These are fed into a compressing machine which removes all air from the container and seals a metal lid in place To make doubly sure that no air leaks in the sealed containers are then soldered at the joints Eight hundred work

ers at the Edgewood plant are turning out masks at the rate of about 3 000 a day to build up a huge reserve supply for possible future need. The photograph at the left above shows women workers on the assem bly line attaching canisters to the otherwise completed masks while in the picture at the right a workman is shown placing the mask filled container in the compression machine for sealing

### Army Shooting Match Tests New Rifles



Cong essmen keep score as daughboys put the Garand and Johnson rifles through their paces

# More Guns To Defend | AMERICA!



O ONE ever heard a fight ng soldier complain that his army had too much art liery

To most Americans and even to some American Army officers last spring a Euro pean war on land brought a success on of stunning surprises. The defense numbing effectiveness of attacks by massed tanks the tremendous h time power of armored d visions breath taking successes won by dive bombers spectacular achievements by dare-everything parachute troops ins dous behind the ines activities of fifth column agents-these developments in the ancient and sometimes honorable trade of war resulted in a quantity of hard thinking by American officers One of the effects has been a mentai rush toward mechan zed war f weapons the mere mention of which only a year ago would have made the faces of traditional minded infantry colonels and hard swearing cavalry brigaders turn purple with rage

Perhaps in a few cases this trend toward mechanization has hardened into a danger ous helief that mechanized weapons in them selves are a solution of all the complex problems of model 1940 war But most of our officers no matter to which arm of the service they may belong have refused to become bland worshippers at the shripe of the mil tarized monkey wrench They ap preciate fully the value of the new war ma chines but that appreciation hasn't shaken the r conviction that the time tested combat team of infantry and art llery remains the backbone of every army and that only ar tillery can make it possible for attacking in fantry to advance and for defending infan try to hold its ground

Adequate artillery support in battle usual ly means comparatively 1 ght infantry losses The regular artillery armament of our big World War divisions of close to 30 000 men consisted of forty-eight 75 millimeter guns and twenty four 155 milli meter howitzers It was so inadequate that whenever an infant, d vision was called not to make an assault its artillery had to be reenforced by the artillery of a divis on in reserve Even then infantry assaults d an it always succeed and infantry losses always succeed and infantry losses the first of three d visions was used to support the ad vance of the infantry of one success came quekly and the infantry of losses were light.

The war strength of our Regular Army's new trangular or streaml ne dhislon is about 12500 men. Its three small regiments of infantry are armed with semiautomatic infles machine guns mortars and 37 milli meter ant tank guns. Its art liery consists of a regiment of thirty s x 5 milli meter guns and a regiment of sixteen 155

very least we should do is to increase the number of 15s millimeter howitzers from sixteen to twenty four We re a rich country—rich enough to buy all the guns we need to defend ourselves against any enemy but not rich enough to pay for the life of a sin gie soldier killed unnecessarily because we fall to see to it that the Army get the guns it needs to do its national defense job. At present our standard light artillery

At present our standard light artillery weapon is the "5 millimeter—about three mch gun Contrary to common belief the guns our army is using today arent the famous French built 1897 model. 75 s with which we fought in France but guns built from French designs in American Army





Moto zed light artillery on the maich. A regiment of thirty siz 75 s has a train of 110 vehicles

arsenale late in the World War and shortly fatter it With the or gual carriage they had a maximum range of five and a balled miles. With the new American despired M 2 high speed carriage which permits an elevation of forty five degrees and a traverae of eighty five degrees their range is over seven and a half miles

The Army has a stock of well over 4 000 of these guns Some are being used by the Regulars and the National Guard and the Restare in storage Although they are old enough to vote most of them are as good as hely were the day they were insished of about \$5 000 each they are the equals of any guins of their call ber in the world.

All our field artillerymen speak affection ately of the 75 but not all of them are convinced that it is the best possible weapon for its primary purpose—the direct support of infantry with its are. Many of them of the support of the support of the support of designed and after several years of experimenting recently perfected by our Ordnance Department, is more effective.

The greatest advantage of the 105 over the 75 is the larger burstling charge of its shell A battery of four 75 a can cover a front of 120 yards with its fire a battery of four 105 a can cover a front of 160 yards 11 takes an average of 800 fifteen pound 75 millimeter abells to blast a lane thirty ment birty yards deep and 4000 yards away an average of 505 thirty three pound 305 millimeter shells will do the joh Another advantage of the 105 is that in hilly or profect up country its high angle fire can reach targets which the flat rapectory 78 gun cant touch. One of the dia advantages of the 105 is that it weighs a ton more than the 3650 point 75 and so can't be moved quite so fast. Another is can't be moved quite so fast. Another is more tramportation—ind even a regiment of truck drawn 75 a has to have 110 vehicles to carry its men and equipment and 120 rounds of shell for its thirty six guns!

The potency of the 75 as a tank killer is a strong point in its favor. The French did great work with it against the German heavy tanks which their 37 millimeter and tank guns couldn't do more than dent. Urn pres at our manuvers always fing down a tank and count it a casualty if it is unaverse crough to make a target of thesit within 1000 yards or so of a 75 in fring position.

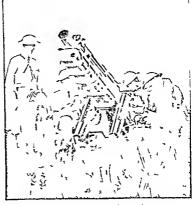
OUR ofher high artillery weapon is the J5 minuteer howiter also poson to tanks. Hauled swiftly on the road or across country by half tracks. It gives artillery support to new Meennaned Cavalry Brigade. only 1470 pounds which and weighing only 1470 pounds which are not support to the result of th

Our medium artillers consists of an undisclosed number of 155 milhimeter howitzers—modernized four ton World War guns which fire a nunety five pound shell seven miles and which towed by trucks can do about 140 miles a day on the road

EWEST and longest ranged of our heavy artillery weapons is the fifteen ton 155 millimeter gun which has a range of fifteen miles Towed by tractor it can be moved 100 miles a day French built World War guns of the same caliber which we still have in service have a range of ten miles Our heaviest field gun is the 240 millimeter howitz er-a tractor hauled thir monster which tv ton throws a 345 pound shell nine miles

There still are some field artillery reguments the stirring for action to the stirring for accompaniment of thud ding hoofs and rumhling wooden wheels In all probability, there will

he a few of these picturesque horse drawn gun regiments in our Army for a good many years to come Theres plenty of rough country left in the Americas and in real rough country lighting a horse drawn



Poson to tanks our 75 m Il meter how trer has won its place as a tillery support to ha d hiting from cavalry

gun can move around faster than a truck drawn gun But almost three quarters of our light artillery has already been motor ized as well as all our medium and heavy artillery

The reason for the change is that motor

ized artillery can move faster and farther on the road With its six horse team galloping a seventy five milli meter gun can be moved for a strictly limited distance at a top speed of about twelve miles an hour Amotor truck can haul a 75 mounted on a pneumatic tired high speed carriage (Con tinued on page 230) mined on page 230)



For rough country a spec al model of the 75 how tzer is token apa t and carred on s x army mules backs



The 14 m le concrete pontaon bridge across Lake Washington as it appears when flum nated at night

ToLL gates awang open recedily to mark the completion of one of the great engineering feats of all time—the danning construction of a mile and a quarter vehical in things that finate on the surface of the water Connecting the peninstar city of Seattle Wash with the mainland to the east, the noat up bridge by far the longer of its type in the world is the key him in a 30 00 000 lightway project that also is a 30 00 000 lightway project that also is not only in the surface of the sur

and from the heart of the northwest me tropolis

Thei together with huge bolts and an chored security to the bottom of Lake Washington twenty five giant air filled concrete pontions form a broad four lane their outplaire. Cast in deep molds as large as a city block, the concrete pontions were floot could be considered to the constitution of the constitu

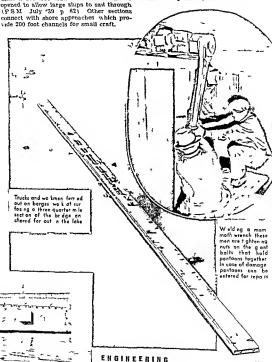
One of the sections of the sizty foot wide flooting high way before I was locked into place. Note the tangues at the end which fitted into gloves in the next section.



forty concrete anchors each tipping the scales at sixty five tons and equipped with hydraulic nozzles by which they dug them seives deep into the soft lake bottom

In its completed form the floating bridge really has four solid rigidly bolted sections. The middle section a single concrete girder 4520 feet long is actually the longest boat in existence. The section near an island over which the bridge route passes contains a 378 foot draw hink which can be opened to allow large ships to sail through (PS M July 329 R 2). Other sections connect with shore approaches which pro-

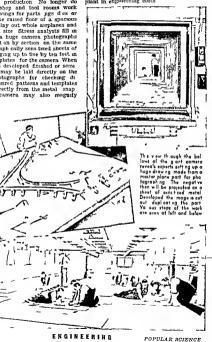
Special connections between the floating span and the shore approaches allow for contraction or evpansion due to weather for side motion of the span during violent storms and for vertical movement caused by a rise or fall in the lake level. The water itself absorbs the weight and jar of traffic Engineers figure that if all four eleven foot lanes were fammed with loaded trucks the bridge would sink into the water for a distance of only six inches



### Photos Replace Airplane Plans

PHOTOGRAPHY on a giant scale is helping the Glenn L. Martin plant at Baltimore Md to play a lead ng part in speeding up na tional airplane production. No longer do craftsmen in shop and tool rooms work from scale drawings for parts 11gs des or fixtures. On the raised floor of a spacious loft engineers lay out whole simplanes and parts to actual size Stress analysts fill in details Then a huge camera photographs the design sect on by section on the same scale Photograph cally sens tized sheets of aluminum ranging up to five by ten feet in s ze serve as plates for the camera When they have been developed finished or semi finished work may be laid directly on the aluminum photographs for checking di mensions If desired patterns and templates may be cut d rectly from the metal snap shots The camera may also magnify

drawings in order to allow for shrinkage in castings It is estimated that the new process is saying \$80 000 a year at the Martin plant in engineering costs





autos aDay!

In the assembly I ne the body of a new Fo d is lowered onto the chass s

LIVE MILES west of the heart of Detrot Mich on the banks of single manufacturing plant in the world Sprawled over land that could accommodate more than 1000 foot ball griditions this Gargantum factory employs 80 000 men and can turn out 6000 automobiles in a single two



## STEELS FOR CARS Mommoth furnaces and foundres t ons form on are into steel and ran Here steel pours f om an apen hea th furnace

### By E. W. MURTFELDT

shift sixteen hour day That's better than one complete ready to run car every ten seconds

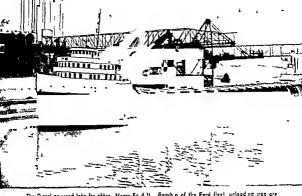
A but a see view of the maze of the state function of the state function tool and die shops power bouses ore docks aralycads foundries laboratories and offices in this gunt Ford Motor Company plant presents the first impression of one wast chaotic tangle Yet by a miracle of scenece and industrial or ganazation the sprawling parts are considered to the state of the st

To get any idea of the tremendous size of this manufacturing monster and of the miracle of production it a complishes you have to begin at the beginning which means that you run into this fact. The origins of the vehicles that come from this mainmoth mechanical batchery are scattered over the face of the earth.

For the Rouge plant taps the raw ma







flagsh p of the Ford fleet unlanding from ore The Dosel powered lake freighter Henry Fo d 11

terial resources of the world. Up from Bra. zil and the Far East come boatloads of rau rubber for tires and bodies Down through the western Great Lakes flows a steady stream of long barges stuffed with iron ore for the blast furnaces Coal trundles in from the South So vast is the demand of the factory for materials that officials state that the plant taps not only many foreign lands but also practically every one of the 3 070 counties in the United States for at least one contribution to its finished product

Trains and trucks haut their quota of materials to the plant but the hon's share of the transportation job is intrusted to ships The Ford company maintains its own freighter fleet of twenty nine vessels led by the 614 foot Diesel powered flagship Henry Ford II Up the River Rouge the freighter armada noses up to the factory s huge un loading pier where glant mechanical fists grab fifteen ton handfuls of iron ore and dump them into a vast storage bin that lines the side of the boat wharf

On schedule and without interruption this influx of raw materials spreads out from docks and receiving platforms along trans portation fingers that lead to the maze of manufacturing and processing plants For this distribution job there are 100 miles of railroad track within the Rouge boundaries Over this network of steel ten steam loco motives and seven oil electric engines haul more than 1 000 plant freight cars There are fourteen giant locomotive cranes as well as fleets of trucks tractors and trail And what this transportation army cannot handle is intrusted to a conveyor belt system that is long enough to stretch from New York City to Wilmington Del and ranges from heavy mechanisms to move bulky raw materials to light conveyors that speed small parts into the hands of work men when and where they need them

Either in their original or in their proc essed form all these materials are ulti mately destined for the spinal column of the factor; the final assembly line But most of them face a long journey before they are joined to the automobile skeleton to play their part in forming the finished

Take for example one raw material fron ore of which some 850 000 tons arrive at the Rouge docks in a single season 'The raw ore is fed into the mans of two giant blast fur naces that in twenty four hours can turn out 1500 tons of pig iron As it emerges the flow splits some of the iron moving into the seventeen acre foundry to be made into

### A VISIT TO AN INDUSTRIAL WONDERLAND . . . THE LARGEST FACTORY IN THE WORLD



### RUBBER FROM BRAZIL AND THE FAR EAST goes nto the moting of ties and of rubbe body ports. Abo is now to in the huge new tie ptonl is seen removing ab and new white we dot let om the oung mold

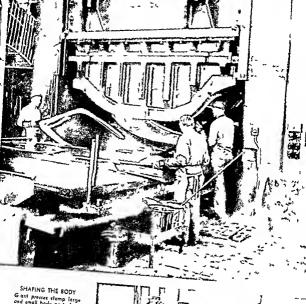
MASS PRODUCTION OF UPHOLSTERY Using election in esthese water in the uphostely plant alecuting fifty pieces of cloth at once for seat covers









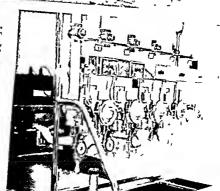


SMAPING IME BUDY

G and presses stomp large
and small bady parts from
thesis af steel. The pc
ture above shows how bady
tops are praduced. There
are 2000 power presses
the most powerful of which
exe t on 800 ton pressure

### PRECISION TESTING

The del cate nitrument at the right is being used to gouge the kiness of the capper plating upon a can next ing rad bear in the normal to one of the nonumerable fests to maintain accuracy.





BAKING ON THE BODY FINISH
Afte the body a assembled t a cleaned
and panted with a synthetic enamel which
a then d ed by lamps as pictured above

cast ugs including the one piece eight cyl inder Ford engine block

Another stream of iron in moleen state mo ea into the open hearth building where in ten huge furnaces it merges with scrap iron limestone magnesium chrome sand d im and various other alloys to be converted into the sixty three distinct types of steel that go into the manufacture of Ford but it can.

Follow the trail farther On conveyors ingots of steel travel to the roil ng mill—twenty two acres—where gigantic machinery rolls them into bars or rods or wide coils of shee atted Go on into the press of 2000 power presses, owner exerting on 500 ton scueeze stamp out fetuders hoods radiators soly panels and other parts as

easily as a chef wields a cooky cutter Near by in a connecting building you'll watch forty steam hammers and sixty up setters a type of forging machine turn out springs and small parts. Since the original pig iron entered the open hearth building its progress has gone on in separate shops that are all connected and covered by a sin gie roof under which if you wanted to as eep out a few housand tons of mach zery you could lay out close to 1 000 tennis courts

But you've only followed the factory trail of iron ore To do the job right; you daiso follow raw rubber through its mare of follow silves and alkalls to their completed form as window and windsheld gives you've travel through the plant where of 1 is extracted from soy beans to form a constitue and of body earned and the remainder util parts as d strubutor houvings and ignition coil cases

But whatever material you follow it will eventually wind up somewhere along one of the three parallel final assembly lines. To get an isles of what these are like think of a mammoth parade that starts with a small group at the beginning of an avenue that group at the beginning of an avenue that of the start of the s

A secon I group joins the parade at the next corner and so on until the parade is a single

marching unit.

The same thing happens in an automobile final assembly line Starting the parade is the chassis which moves along on a con vevor until at the first side street engine assembled in the motor huilding moves in on a conveyor from the left and is lowered into place Radiator steering gear fenders wheels bodies and other parts are added as the steadily expanding unit moves from one side conveyor along to the And remember that each of these side street conveyors is an assembly line in itself for each major part has been built up from a number of smaller units Finally when the mechanism arrives at the end of the line it is a complete ready to operate automobile and rolls off the conveyor under the guidance of an inspector who draves it out onto a half mile test track for a check

But long before you reach the point where minshed cars roll off the assembly lines you will probably reflect that it must take powe, with a capital P to run the thousands of machines and light the myriads by lamps in a plant of this size R lodes The factory power house the largest industrial bigg! ressure power plant in the world, whitely pressure power plant in the world, whitlers! three giant turbo generators that can pro duce erough current in a single day to meet the electrical requirements of the average American home for 13 533 years!

Coal the principal power house fuel is used in pulserized form and blown under pressure into the boilers where it burns at most like a gas. Every day the power house pumps water from the Detroit River through a 2 - mile tunnel in a quantity that equals the daily water consumption of the cities of Detroit Cincinnati and Washington combined.

These are facts and figures that set the hram whirling. So before you leave the plant perhaps you had better taper of with a few factory activities that Ford officials class as incidentals. By products for example. Stag from the blast furnaces is ample stag from the blast furnaces in continuous of 2000 barrels. The most permises that has a daily capacity of 2000 barrels. From the coke ovens come such by products as coal tar ammonium sulphate for fertilizer light machine oil and motor feerod among others.

Of consider plant sanitation Nearly 5 000

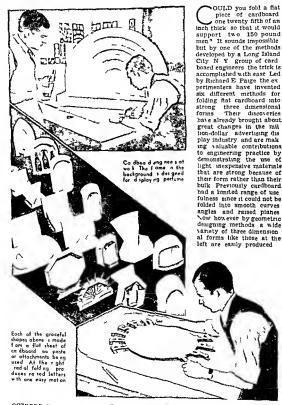


men are assigned to the job of keeping buildings and machinery clean and safe Each month they use around 7 000 mops 2 700 brooms fifteen tons of soan chips and 32 500 gallons of paint. The Broige plant has more than 8 000-000 square feet of floor to be scrubbed and swent!

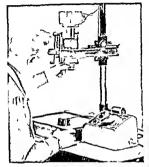
With its 6,000 cars a day capacity the Puer Bourge plant is a tremendously important cog in the peacetime industrial life of the nation And with half a world along with chern of its kind may become of even greater importance as a mighty factor in America a national defense because of ability to revice over the table in a builty to revice over to tasks and in the common of the c

ASSEMBLY LINE Conveyors like the one at the right by any finished parts to workers on the assembly lines. Below lamps are adjusted as completed cors roll and the seas oil ready for test runs and the soad y for test runs and the soad.

### Working Wonders with Cardboard



## LATEST AIDS FOR



### Enlarging Meter and Timer

only determines the number of seconds needed for an enlargement exposure but also controls the exposure shutting off the light at the proper time No test strips are required. The device adjusts itself automatically for prints of various sizes in which the light source is nearer or farther from the paper

#### Turret View Finder for Movie Camera

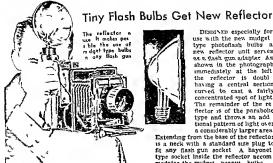
View No the scene to be recorded with a home move camera equipped with three lenses mounted on a furrer is amplified by the addition of a miniature turret holding a trio of toxing lenses each showing the same area as one of the main lenses by bringing the corresponding viewing lens into position the area lin cluded by each taking lens is seen



There's a viewing lens for each of three taking lenses on this home movie camera



## CAMERA FANS



DESIGNED especially for use with the new midget type photoflash bulbs a new reflector unit serves es a flash gun adapter As shown in the photograph immediately at the left the reflector is doubl having a central section curved to cast a fairly concentrated spot of light The remainder of the re flector is of the parabolic type and throws an add tional pattern of light over a considerably larger area

Extending from the base of the reflector is a neck with a standard size plug to fit any flash gun socket A hayonet type socket inside the reflector accom modates the midget peanut hulba

### Thermometer Is Set in Hose

AS AN aid to getting ex actly the right temperature in water used for photo graphic solutions a ther mometer has been incorpo rated in a rubber hose. The hose is attached to a comhined hot and cold water faucet and the flow of water is regulated until the des red temperature is shown



#### Handy Camera View Finder

WAIST LEVEL VIEW finders that can be alipped in place on the front support of the camera are non available for users of folding cameras equipped only with eyc level finders. The lower newpoint is often desirable especially in taking pictures of pets and children

### Dial Makes "Timer" of Any Clock



TURNING any clock into a darkroom timer a new dial can be attached or removed in a few seconds A suction cup holds it to the glass face cover of the timepiece By setting the dial in relation to the minute or second hand the user can deter mme by the duals atop arrow the end of any de s red exposure or develop ment period.



How the wast level vew finder mounts on the base of a camera

### New Photo Process Yields Color Prints



### Gutters for Dorkroom Aprons

A DARKROOM aprob with a trough around the bottom is a novel aid to preventing clothes and aboes from be coming stained by photographic chemicals. The trough is produced by turning up the bottom of the lightweight rubberned apron and fastening it with metal buttons to catch stray drops of chemicals.



# Cable Release Is Armared

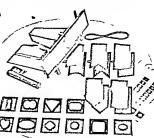
lease cables equipped with an outer covering of flexible metal offer increased resistance to wear With threads that fit standard shutters the new cables are available in various lengths even as long as 100 feet.



The folded up apron edge keeps I q u ds from dr pp ng onto the clothes

Scenes can be framed in almost any shape with the framing autf that the right. The cut out masks are insert ad in the box ke lens attachment

### Framer Gives Home Movies a Professional Touch



NPHOLES hearts chevrons diamonds and binocular leases are some of the wide variety of framing effects for motion picture scenes and titles obtainable with a framing unit now available Quickly at tached to any eight or sixteen milimeter camera the unit utilizes a light-tight metal box fitted with a vibrationproof silde in which various metal masks may be inserted

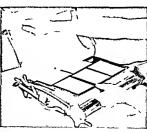
In addition the framer is equipped with eight variable inses for obtaining novel fade in and fade-out effects. The iris attachments are directly adjustable by means of a finger control. Light in weight, the framing unit may be used in either a vertical or a horizontal position.

#### Easily Applied Fluid Hardens Negatives

Now available to amateur photographers a liquid preparation protects neg atives from scratches and finger marks, keeps them pliable and prevents them from curing Suitable for both still and motion-picture film the material permeates and becomes part of the emul sion, rendering it resistant to damage



The liquid is simply wiped over the surface of the negative with a soft, lintless clath



#### New Automatic Print Drier

ADJUSTABLE thermostatic control, automatic tum-off, and buttess canvas curtains are some of the outstanding features of a new electric print diece. Accommodating two ten-by-four teen unch ferrotype plates, the unit may also be used for mat-surface drying. The apparatus draws only 300 watts of electric current.



### Suitcase Is Emergency Crib

refugee hip from the Medicultramean island of Malta an agestious mother converted a su tease not a comb auton hed and carrage for her four month old son. The illustration above shows them packed for the trip with the haby watching the vew through an improvised window. A lettered sp insured careful handling of the erip.

#### Electric Tool Cuts Door-Lock Mortises

IN a single operation requiring only a complete mortise for a door lock in a complete mortise for a door lock in relaiding recesses for both the lock bar relaid face plate Splitting the wood is declared impossible, and the work is finished forly I mes as quickly as by hand Once a height rod bas been ad justed the device is self-locating

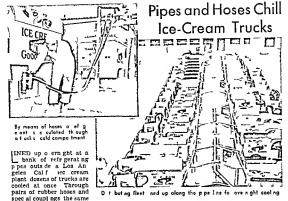


The mach ne in use It cuts a mort se for a door lock forty times faster than by hand

The game pe m is siteen offense plays and as many for the defen

#### Quarterbacks Match Wits at Table Football

Would be quarterbacks may match wits with a new indoor football game By moving a slide on a covered playing board the offense may secretly call for any one of sixteen plays At the same mo ment the defense moves a second slide to what he thinks the play will he Uncovering the board re veals yardage gained or Accessories keep track of the ball and the progress of the game

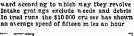


refr gerant used in the factory circulates through each truck s cold compartment a metal chamber insulated from heat by a secret compound resembling gelat n In the morning a mechanic disconnects the pipes and the trucks chilled sufficiently for all day service are ready to d stribute the com pany s product

### Propellerless Boat Draws Little Water

REQUIRING I tile more than a foot of wa ter a propellerless rotorboat created for a customer's Mississ ppl River jaunts by a veteran St. Paul Vinn builder Its forty horsepover gasoine en

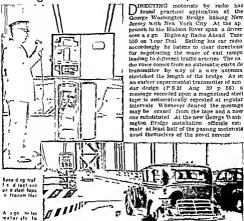
g ne operates to n rotors inclosed in cones of thirty three inch max imum diameter Working much I ke the blower part of a vacuum cleaner the rotors dra t in nater and expel it through openings n the hull pro pell ng the boat forward or back





owing at the left this cuse can no gate R ver wate s as I tile as one fact deep

### Bridge Traffic Is Controlled by Radio



A sgn nvtes mater sts to tune n on the ado control



Mechan wal mason at work. An elect a mater which the t awel blades

#### Rotory Trowels Quickly Smooth Cement Floors

THESE rolary trowels whirling 100 revolutions a minute in a new wandows devised by a California invention and the second of the

### Lamp for Typists Holds Manuscript

DESK LAMP and copy holder are com bined in a new convenience for typists Wire clips hold in the 1 ght the pages to be transcribed while the lamp shade shields the typist s eyes as seen in the photograph at the right.

#### Oxygen Gives Diesels a Shot in the Arm

ONIGEN fed into the intake air of a Desel engine increases its power out put by fifty five percent for a few minutes without undue strain according to Prof. Paul H. Schweitzer of Pennsylvama State College who suggests that the method be used to stumulate Diesel airplaine engines for the heavy load of taking off.



Cl ps on the lamp stand hold the pages to be transcr i

casting Company's station W2XBS

transform a kaleidoscope from a child's

### Kaleidoscope Paints Television Screen

KALEIDOSCOPE pictures have gone on the air Just as musical selections fill interludes in sound broadcasting the eye pleasing pat terms of light entertain lookers in between television features from the National Broad

plaything into a scientific novelty of 1940 engineers first photograph a simple design upon move film. The film then passes through a studio projector tube lined with mirrors which multiply the design eight times to produce a symmetrical image. Two auxiliary projectors make a frame for the pictures, and superimpose any desired words or symbols upon the designs.

A kale doscope p a ture pattern as seen on the screen of the telev s on rece ver

In the stud o simple designs photograph ed on film are pa jected through a tube lined by min are



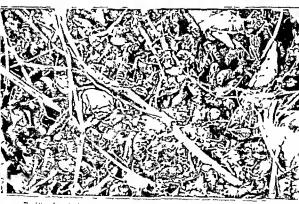
# Seventeen-Year Locust

JUST 306 years ago the Pilgrim Fathers at Plymouth Mass were appalled at the sight of hundreds of thousands of winged and fiery eyed creatures crawling from the ground They mistook them for a plague of Biblical locusts and the super stitious noticing that the letter W was formed by the wing veins of the insects believed them an omnous warning of war

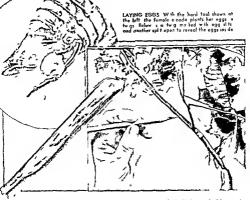
In recent weeks descendants of these identical creatures have reappeared in Eastern woods Once again from Binois to the Atlantic seaboard from New Eng land to Georgia one of Nature's strangest dramas—the return of the seventeen year locust or periodic cicada—has reached a chinax. When that drama began in 1923 Hard ga was president flappers were in the headlines radio was just rising into popularity Like awakening Rip Van Winkles these insects now have emerged for a few short weeks of sunsh a end open air after

nearly two decades of darkness of sucking sap from rootlets of burrowing through the damp earth of an insect underworld

While this brief mating season was at its height I recently accompanied the noted cicada expert William T Davis of Staten Island N Y to a spot where the activity was greatest the Half Hollow Hills region of central Long Island Everywhere around us heavy bodied insects with reddish eyes and yellow veined wings were fluttering among the trees Ridding the ground at our feet were countless holes about the size of a 45 callber builet. In some places they showed that the emerging insects had nushed their way up through gravel and even among small stones Their brown discarded skins clung to weeds twigs and bark or lay in little windrows among the tree roots Striking against the leaves the wings of the insect hosts produced a con tinuous sound like failing rain As we



This litter of emply skins indicates the vost numbers of the insects that appear at seventeen year intervals. After their long imprisonment in the earth they eme ge for a few weeks to mate and die



wound mile after mile along country roads a steady roar like breaking surf arose on either hand—tha din of a million tiny insect drume heing vibrated at once as male cicadas vied with each other in calling for mates

This remarkable sight has been witnessed by Daws probably more often than by any other living man. In 1877 when he was a boy of fifteen he saw it first Today at the sight of the condata. Educational institutions and of the condata. Educational institutions and institutions are considered to the condata of the condata of

AS WE moved through woods achoung with the roar of the issect multifusies he told me something of the cursous sound producing mechanism of the males. It is a tiny drum formed of corrugated membrane located near the base of the wing. No other insect in the world produces sound in a similar way and only the makes peases the similar way and only the makes peases the females alight near the drumming males seemingly attracted by the sound lie has also seen other males descend beside each solid or with the large state of the control of the contro

peabus rage but their ravals like goats: A curnous thing in connection with the effect of certain sounds on cleadas was observed a few years ago by a scientist in Kanssa. He noticed that the insects alighted in large numbers on tractore used in pilowing. The drumming of the engines apparently attracted them to the machines.

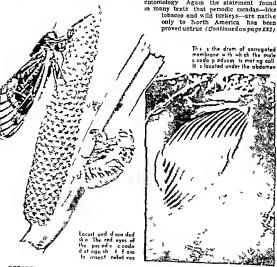
Some relatives of our seventeen year create Davis told ne use their drims to produce strange and alarming sound effects sendly unique lasert hear grown and create market was a market was

by puned in wooden boven that stand row on row in Dayus Staten Listand isborstory are most of the strange creates of the world. There is the buggest known an unworld. There is the buggest known as unspread and a body far larger than that of a Eumming bird. There is also the timest exects a midget hardly half an inch long from Tenas. There are stop and go of from Tenas. There are stop and go of the Anders so called because they have bright red spots on the hind wings and bright green ones on the fore wings. There is one species with a jet black body and a strawberry red nose and another which is bright green and known locally in Australia as the Green Monday Probably the most currous of all the specimens is an Austral an cicada with a boillow balloon like abdomen which acts as a sounding board to amplify the noise of the tiny drums

Several of the insects among the aeven teen year cicadas and their relatives in Davis s collection were obtained under rather unsulves the graysth brown desert cicada for instance which has been found only in automother. The first two specimens to come to the at tention of science—one arriving at Davis laboratory and the other at Oxford University England—were both discovered in motor cars after fournats had driven through desert country in western gates.

In another case a friend of Daviss was traveling in a remote island of the Carib bean Sea when he heard creades in a wood land He made arrangements with a local taxi man to collect some of the insext and send them to Davis. The man did such a good job that Davis showed his apprecia thon by naming one of the cleadas in his honor and publishing an account of it nas secentific bulletin. Immediately afterwards the taxi man disappeared if developed the he was a fugitive from justice who had considered himself safe on the out of the way island. Then by capturing a bug he had thrust himself into the limitative limit he was a fugitive from pusitive with a such as the control of the safe through the safe through the safe through the safe thrust himself into the limitative.

While many of the 2 000 different species of cicadas known to entomology have strange shapes and even stranger habits the most ceitbrated is still the seventeen year locust of our Pastern States As we watched the great hosts of these creatures in the woods of the Half Hollow Hills Davis told me a few of the it isn't so's about them. In the first place, they are not locusts but an entirely different kind of insect. The Pilgrim Fathers called them locusts and the name has stuck in spite of entomology. Again the statement found in many texts, that periodic creates—like



# Here's My Story

EDWARD V RICKENBACKER WAS BORN IN COLUMBUS, OHIO OCT 8,1890



AFTER HIS FATHER DED 12-YEAR-OLD EDDIE CLAIM NO HE WAS 14 GOT A N GMT JOB IN A GLASS FACTORY HE WORKED 12 HOURS A NIGHT FOR \$350 A WEEK



LATER DECIDING TO BECOME AN ENGINEER WE WENT TO NIGHT SCHOOL COURSES FAGUNATED BY AUTOMOBILES WE STATED WORK WITHOUT SALARY SWEPPING FLORS IN AN AUTO FACTORY



POST OF PERSONAL MECHANIC AND RACING ASSISTANT TO HIS BOSS LEE FRAYER WITH WHOM HE RODE IN VANDERBILT CUP RACES ON LONG ISLAND N.



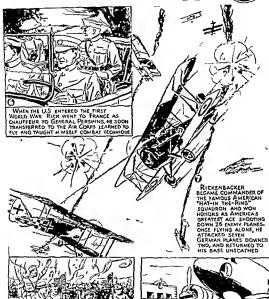
SHORTLY AFTERWARD HE BECAME AN AUTOMOBILE SALESMAN BECAUSE SPEED SOLD CARS IN THOSE DAYS RICK ENTERED ALL THE COUNTY FAIR AUTO PLACES HE COULD





## THE CAREER OF CAPT. EDDIE RICKENBACKER

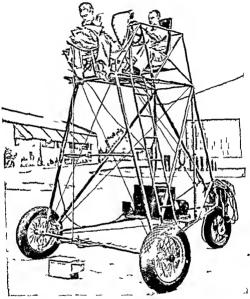








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## "Tricycle" Trains Army Bombers

First: FP on an odd three wheeled frame work of metal tubing a U S Army pilot and his bombarder are petured above at Pivers de Cal f getting in some ground bombing practice with an electrical mathine said to simulate actual bombing con

89

d tions A fall ng plumb bob plays the rôle of a both Note that the bomb a ght a closely guarded Air Corps secret since it is reputed to be the most accurate in the world is covered with a bood to hide it from the prying eye of the camera.



Joseph Rost ck right consulting his pilot before a flight

### Flying Dock Master Spots Ships by Air

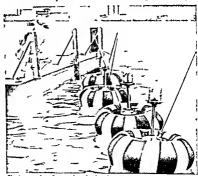
CONTRINC his beat by air saves untail time and trouble for Joseph Rostick New York dock master whose duty is to collect wharfage fees from transient boats using city owned facilities Piloted in a light plane along miles of waterfront be readily spots new arrivals tied up at the piers. Thus he finds out just where to pay his calls when he gets brek to earth without wasting time hunting his customers.

### Quinine Cures Fever in Airplanes, Too

QUILINF long a medical stand by for combating high fevers has a similar value in aviation accord ing to researches made recently in the laboratories of the Standard Oil Company at Cleveland Ohio It was found that small quantities of the drug added to lubricating oil keep the oil from decomposing at the high temperatures produced in airplane engines

### Radio Controls Seaplane Landing Buoys

TURNED on ani off by radio control new lamps on air filled rub per floats will outline safe landing james for alreraft in U 5 har bors Green jights mark the entrance to the aquatic runway yellow lights are spaced along . its 5 000 foot length and red lights show its end Powered by dry cells the lamps are of the new fluorescent type in which glowing chem icals provide the iffu mination Their dough nut shaped floats bear black and yellow stripes for daytime visibility The softly inflated floats are no hazard to wa ter eraft and tests have shown that they are not easily damaged by collisions



Floating makes for seaplane landing lanes. Note radio cont of antenna

# MOW AIRLIME

CUDDING across a broad black runway at the world's largest almort in New York City an American Airlines transport wings into the air on a 1000 mile non stop flight. Up in the cockpit a seasoned transport captain vet eran of hundreds of aerial voy ages guides the plane westward Reside him his assistant called

Erst Officer Hatch bulls in the flag Below he s seen with his fellow students Dugan and McCo mck or r y na at LaGuard a Feld for training



from the U S Art v one as experienced commercial ; ilot and

tle th I from the L S Valj EDWIN HATCH came to the alt

I ne school from the Arms Air Corps After graduating

from the Advanced Flying School at Ketly Field Tex in 1939 he remained in the Army until January 1940

WHE's he was a junfor in high school

"" Il McCormick learned to fly In 1933 he was selected to accompany Ad miral Richard E Byrd to Little America

as an auto-iro p lot. On his return he served as a flying instructor and after 2000 hours of commercial fiving de cided to enter training as an airline p lot

BORN in Wem 1916 Edward Du gan joined the U.S. vavy to 1935 He received flight

trate ng at Mtami and at the Pensacola Fla Naval Air Station and then served on the Pensacola and the air craft carrier Pa ger He entered the pilot school in January 1940



Edwa d J Dugan

McCorm ch

# CAPTAIMS ARE MADE

the first officer is off on his initial flight as a member of the plane crew starting a transport career that will lead him to a \$9 000 a year job as captain of a flying flagship

What does it take to make an airline captain? How does a candidate qualify for the job? How is be trained for a post where he will be entrusted with the air safety of twenty one passengers and a \$120,000 plane?

American Airlines selects its pilots at a rate now approaching one a day from three men sources commercial military and naval aviation. A prospec tive first officer must have a commercial license with at least 1000 bours of fly ing or its equivalent in Army or Navy air experi ence He must he a citizen of the United States and not more than thirty two He must have perfect health a pleasing person slity and a real love for the joh

Of the three hudding first officers whose training

- Newly arrived the froining classmen take a look at one of the big flogships they soon hope to be oble to fly An instructor is pointing to a diection finding ontenna
- 2 Old fash aned class com
  exam nations reveal the
  would be plots technical
  knowledge of flying in the
  background is the Link train
  er used in blind flying tests
- 3 Accepted for enrollment the three students d aw ther books for study. The stacks of manuals and instruct on sheets will reque many hous of burning midnight oil





earer is followed in the ac companying photographs one came from the Army Air Corps one from duty aboard a Navy aircraft carrier and one from commercial flying on the Pacific coast. All three passed their physical examinations with flying colors and started their training together in month account of the physical examination of the phys

Recause the trio like all other candidates for flaeshin berths were already accomplished fivers their training was designed primarily to familiarize them with airline procedures and the handling of the giant twelve ton Donetas twin motor trans port pianes. Their first schooling consisted of a series of lectures given by veteran pilots and specialists on subjects that ranged from mete prology radio and naviga tion to civil air regulations and general airline opera frons

By observation and actual work in the huge mainte anance and repair shops of the airline they learned about the operation and upkeep of all parts of their planes hydraulic landing gear bat teries fuel heating and venti

A fractical knowledge is quite to simpartant as theory. Here Dugan McCorm ch and Hotch are being shown the workings of the controllable pitch is popular by an American Arlines methans

5 On a four through the shaps of LaGuard a Feld the to of young plots examines a plane rade receiver he may controlled. They familiar the masters with the ground sevice arganization

6 In the plats lounge Hangar No. 1 they do ther handwark to total plenty of hard wark to eat sty the arline afficials that a young man is qualfed to it sper one of the big flogsh pt

lating systems engines and propellers

In the school headquarters they spent long hours under the hood of one of the school is too Link trainers practicing navigation instrument read ing location and meaning of radio beam signals and test approaches to various flying fields. Each time they ing fields Each time they ing fields in the Link an instructor pointed out their mistakes as recorded by the automatic device that these every movement of the imaginary flight.

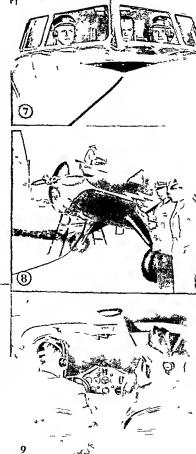
Their first actual flying as student officers came in the companys Stinson trainer planes Here the fledging captains practiced instrument flying in the curtain strouded cockput From this they progressed to flights in the transport planes and finally to fifty hours of line checks flights in regularly scheduled planes as a third member of the sh ps crew

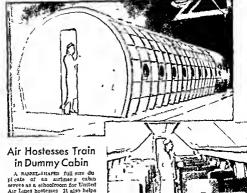
From this (wo month period of intensive training the students finally emerged as first officers started to earn their monthly salary of \$190 Their pay will be increased twenty dollars every six months until it reaches \$350 when they should be ready for appointment as captains

With an experienced plot to cooch them they climb atto the cockpt at a Dauglos DC 3 for a practice flight. Soon they will know the complicated routine at flying one of these big a liners.

B Student Hatch in uniform is ready to take aff in a Stinson taining plane for a blind flying test. After proving his skill in this smaller ship he will go an to the regular to apport coff to

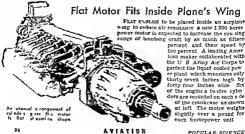
O W the black hood cove ag the ten ng plones wadsheld so that he connat see aut Hatch pepares to take off fly and land with only he nationaries and rada signols to guide him



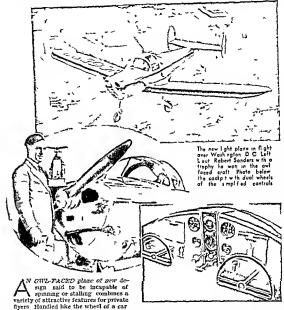


A BARREL-SHAPED full size du pl cate of an airliner's cabin server as a shoofroom for United art. Lines hotelesses TA size belos guart forty passenger planes that the company will put in operation text year. Built at Burbank Calf the \$10.00 wooden model measures mxty feet long—the length of an actual fuselage misus the plotte compartment and the tail section.

Hostess chots with possengers in the sixty foot model of a transport plane cabin. In the exterior view above, the door at the end co responds to the opening from the plots cockpit



## "Owl Plane" Can't Spin or Stall



sign said to the incapation of a variety of attractive features for private hyperstanding the said of a variety of attractive features for private from than the said of the s

According to the maker the new plane flees twenty six miles on a gallon or gas and a fuel capacity of fourteen gallons gives it a 350 mile crujang range. Its sixty five horsepower motor propels it at a cruising speed of 105 miles an hour and a top speed of 107 miles an bour Sturdy and powerful enough to he flown safely in weather that would keep many light planes grounded the state of the same of the same states and the same states are states that cause it to be full affected by winds of as high velocity as fifty miles an hour



### **GET THIRD DEGREE**

OVIE CAMERAS hits of colored varn and a bomblike instrument lowered on a cable have been help ing to check the maneuvering and landing performance of newly completed warplanes at an aircraft plant near Burhank Calif

Aloft on a test flight the plot Milo Burcham tries stalling a swift ship with power on and then off landing wheels up and down and wing flaps in various stages

of extension

Meanwhile the flight engineer R. L. Thoren takes movies of fourteen instruments housed in a miniature tunnel and il luminated by powerful lamps These re peater dials duplicate the readings of standard dals on the planes instrument Resulting photos show smul taneously the plane a speed the angles of its afterons positions of rudders and ele vators outside air temperature direction of flight and time to the second

At the same time an assistant oper ates a s xteen millimeter movie camera bolted firmly to a steel post in the cabin and trained through a window on one wing He photographs an air speed me ter a clock and the antics of seventy eight short streamers of tinted yarn at tached with glue to the upper wing sur face If the plane noses upward into a perfect stall the strings nearest to the ships fuselage acting as tiny weather vanes are the first to reveal eddies and

shifting movements of air flowing over the Gradually the turbulence moves wing toward the wing tip and finally reaches the asseron thus showing that lateral control is being maintained as long as possible

To measure the secret top speed of the mane an additional meter is lowered through a door Shaned like a bomb it noints directly into the air stream no mat ter how the plane turns

After a flight engineers analyze the sneed figures and the two sets of movies te the dials or pleces of varn have revealed any shortcomings necessary changes are made to correct them



Top ar speed—a closely guorded secret s determined by a sensitive indicator in a ambite device that s put out from the par of the cab n on a long cable. The bomb always points directly into the flow of air



The variet of shows the use of the new rad a range antenna

#### Plane Radia Beacan, Like a Lighthause, Has Rotatina Beam

Supering completely around the horizon at the rate of sixty times each second a new radio range beacon constantly shows a plane nulat whather he is fluore toward the beacon or at an angle to it Per fected by the Radio Cornoration of America the new system uses a tiny ground antenna consisting of five metal rods only two feet long and ten inches spart set up as shown at the left. Previous sys tems have required towering an tennas that present a flying hazard In addition to the revolving beam the system sends out a brief signal in all directions just as the narrow revolving beam points north Re sponding to the two signals, a hand on a dial on the plane a instru ment name! sower a continuous read ung of the angle between the direc tion to the transmitter and the direction the plane is flying

### Supercharged Ignition for Airplanes

BECAUSE air within the shielding of the ignition cables of airplane engines becomes contaminated by moisture and combustion gases permitting ignition leaks and speed

ing corrosion Carl E Swanson an air line electrical engineer developed an ignition supercharging system that forces thoroughly filtered air through the cables

Air to the cables is forced

through a final containing filtering chemicals which has about a week in average commercial planes. The new system already has stood the testoof 500 odomics of the system already has stood the testoof 500 odomics of the system already has been set to be sometimes of the system already has been set to be sometim

Fitered ar forced nto the ignt on cable shelds stops contamination. Note the tiny filter for right

98

### He Breeds Bugs To Aid Science



## Radium Detective Uses



### **Electric Bloodhound**

radium rays being amplified into a cracking like radio static. This noise proved disturbing to hospital patients however so the musical chime was substituted. For outdoor work the belt replaces this gong In either case the telltale sound announces that radium is close at hand the frequency of the sound increasing as the apparatus is brought closer and closer.

In a number of instances Hartman has tracked down radium after it had gone through hospital incinerators. The radio active substance cannot be destroyed by fire so it remained unchanged in the ashes nounced he had brought his quarry to bay Sometimes the lost radium is discovered

in hospital corridors at other times in waste material on its way to the linenerstor and occasionally in the finding furnace it seaf in the latter case the ashes are sifted as soon as they have cooled In only four of forty three attempts has Hartman failed to find the radium he sought. So seasilive as his homemade device that it will begin to sound its signal when it is as far as 500 feet from the radioactive metal and will track down of suartities as thry as and will track down of suartities as thry as



# FROM PLAY JOBS



Elemento y sci ool students of Burbonk Calif play at or 1 anspot a se plane they bu it form blocks and bores. Right un o high school boys use maps and re colding instruments to study the weather

N A achoolroom at Burbank Cahf seven year old youngsters build a dummy transport plane One of the boys occupies the pilot s cab n a little girl stands at the door taking tickets and others play the parts of passengers Near hy junior h gh school atudents re bu ld in m n ature the Lockheed Aircraft Company s ma n plant while others con struct a map showing Southern Cali forms a mounta as and airports In Los Angeles boys and gurls of high school age and older engage in fifty one trades at the Frank Wiggins Trade School put ting on the finish ng touches which pre pare them to take real jobs in industry From kindergarten to graduation in

dustrial education in the Southnest follows a new pattern these days. In the lower grades youngsters are encouraged to learn all they can about principal local industries. If the town boasts an aircraft plant or airport they vist the scene and reproducwith cardboard and blocks what they see Such experiences carry many of the push

on to special interests which they are en couraged to develop in junior high and high achools in and around Los Angeles boys and girls are being guided toward industrial jobs Prac tice accompanies theory and their studes take on the realism of day by-day work



Educators know that most high school students cannot find just mercelately on graduation. It is to help avoid this loss in manpower that efforts are being made to fit men and women to industrial jobs and in the Frank Wiggins Trade School a free that wiggins trade School a free Angeles City Board of Education both youths and entitle may prepare in all Indee Thansands who started by building planes from Blocks become stilled arreraft design

ers mechanics and sheet metal workers All students here work with their hands There are no entrance examinations Ad

# TO REAL JOBS



mission to classes is based upon the applicant's personal fitness to profit by the train ing and ability to meet the

trade requirements for employment. Depending upon the demands of the trade for which he proposes to fit himself, he may either have finished the eighth grade, or high school. Since the school proposes not only to train for, but also find a job, each student learns a single spec alty

There are no terms or somesters Students may enter any time, and leave when they find employment Advisory committees rep-



Assudenties a agte of art of cerous as Many is go advised concerns lend equipment to the table school to help supply competent we have

resenting 201 employment levels meet regularly with the instructors mapping study courses and finding jobs for both boys and girls. But the school's influence does not end here. Workers already employed flock to the classrooms where they learn new industrial developments in their various fields and perfect them selves in modern working nethods.

After a student has left school thou ands of follow ups trail him for years for trude education of this sort, to be completely successful must make sure that square pegs are fitted into square holes. Because of these intensive systems of try outs in the elementary schools and preculated me plot training in the trade school employers figuratively stand in line wating to him trade specialists the munite their instructions pronounce them considered their instructions pronounce them the standard of the standard production. The standard is successful to the standard of the



Commercial art is only one of the forty three kinds of work tought to g is. This student is sketch ing a shoe for an advertisement Special optitudes shown in early studes defermine later fraining

Boys teaming to be automobile mechanics must not ther own cooling by teeping their cars in repair. At the left are of them is learning how to use a gauge testing ponel in inset another budding Guy Wison is putting new finish on a fender



# Cartoon Characters Cut Out of Wood

FIGURES of characters seen in moving picture cartoon features are out lined on soft wood boards recently put out in packaged form by a novelty manufacturer as an educational to intended to amuse and instruct children. The outlines make it easy to cut out the figures which may then be painted in appropriate colors and fastened to play room or nursery walls for permanent decorations as pictured in the photograph at the left.



Billy Lee young move actor applying colors to figures of an moted cortoon heroes and heroines cut from soft wood

### College Course Helps Janitors Brush Up

A COLLEGE course for school famitors is a novel addition to the curric ulum of Teacher's Col lege Columbia University, in New York City Given under the super vision of Dr Henry H Linn once a famitor himself and now super intendent of grounds and buildings at the school the intensive course runs for five days and includes instruction in the best methods of sweeping floors polish ing furniture cleaning woodwork and operat ing coal and oil burning furnaces Round table discussions and stu dent teacher consultations are held.



Student you tars get same pointers an operating an oll burner furnace

### New Eyes and Ears

PECIALLY hult classrooms novel sound amplifying systems and many other sc entific aids are now making it eas er for school children who are handicapped by defective hearing or im paired vision. Photographs on these pages show how it is done at Long Beach, Calif. where education authorities have provided

a striking example of the latest technique Each pupil suspected of deafness among the 25 000 children in the Long Beach pubhe school system receives a test with an audiometer This instrument, outwardly resembling a radio cabinet with headphones determines how much a child actually hears.

Pupils showing marked impairment of hearing enter a special class whose teacher talks into a microphone connected to an am platier They listen through earphones By turning a knob on an individual control box, each member of the class can adjust the volume of sound until he hears distinctly

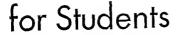
Kindergarten pupils some as young as three years old, may have trouble in learning to talk because they cannot hear their own words. To evercome this difficulty a child watches the teacher's hips and feels her breath on the back of his hand. or places a hand against her throat while at the same time he tries to

At the left o child believed to be hard of hearing is being given a test to show how well she hears



To exercise a weak eye the your wears a rubber cup ove his so At right a deaf child lea as to for speech sounds by watch ng the teachers I ps and feeling her beath on his hand





Children with impa red hearing listen with aurphones while the teacher talks into a microphone. Each has a control box with a knob to regulate sound volume

imitate the sound she is pronouncing. The feel of his own breath or throat serves as a guide. Corresponding sounds appear in large letters on a near-by blackboard.

For pupils with subnormal vision, special aids include reading racks for books, tilt-top desks, glareless tinted paper, and oversize pencils and chalk. Even the classrooms are designed to relieve strain, and studies are changed frequently to rest the eyes If only one eye is impaired, it may be exercised by placing a rubber 'blinder" over the good one Some children learn typing on machines equipped with large type These sight-conservation classes enable students to attend school even when being treated by an eye doctor.

A tilt top desk brings this student's work close to his eyes. Oversize pencils and glareproof finited paper reduce eye strain





### Coach Uses "Blocking Recorder"

To Am in training football players a blocking record or has been devised by a Texal coach Figures on an illuminated panel illustrated above correspond to the eleven men of a team Watching a practice play the coach flashes on a green light for each man who has made a block correctly and a red light for each who has failed By glancing at the recorder members of the team get individual reports on their performance with out need of verbal admonstrain from the coach

### Wire Coils Clean Shotgun Barrel

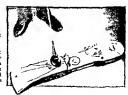
ONE WHEELED roller skates provide a novel means of lo comotion for a young inventor of Los Angeles Calif The oversize wheels adapt the skates for use in places where there are no sidewalks or paved roads



For cleaning a shot gun a new tool employs self sharpening coils of bronze whre soft enough not to damage the steel barrel but hard enough to remove lead or rust. The device may be fitted to a regular shotgun cleaning rod or pulled through the barrel with a stout cord.

### Golf-Drive Practice Aid Registers Hook or Slice

A NAW indoor practice and for goifers not only registers how far a drive would carry but also whether it was sliced or hooked Upon the impact of the club an upright piece of rubber bends to strake a crecutar disk registering the distance of the drive in yards upon a dial. An arrow divertly in front of the dusk shows the direction the hall would travel and a sever at the side resets the mechanism for another type.





"SPOTTING" DEVICE AIDS FOOTBALL ANNOUNCER

That Play?

plicated maneuvers of a football game and still identify by name the ball carrier, tackler and other players involved in the action? One answer to the problem worked out by John Beeston research engineer for radio station WHO in Des Moines Iowa is pictured below In front of the announcer is a slant top box equipped with lights representing all the players on the home and visiting teams Wires lead out to smaller control boxes one set in front of an assistant or spotter familiar with the visiting football squad and another in front of a home squad spotter. The smaller units con tain eleven buttons which actuate lights on the main board. As the teams go into action the spotters press buttons

below the names of the the announcer take he

Lights on the larger panel dentify players as spotters press buttons

backs or linemen engaged in the play and lights flash on the main board to convey the in formation instantly to spotter makes a mis presses twelfth button which flashes a special light to Inform the announcer and thus enable him to correct the error as soon as possible

#### Lightweight, Transparent Rain Suit for Golfers

PROTECTION from ram without noticeable weight or interference with the wearer's freedom of interement, is afforded golfers by a truspapernt rain suit. The suit consists of a long sleeved jacket and trousers.

### Face Net Protects Boat Racer

To regrett the faces of outboard motor boat rac ing pilots from possible injuries in spills, Mike Rogon ski, Detroit, Mich Outboard Association official, de vised the protectine cord face net pictured below



### Anglers' Weed Saw Clears Channel

WEETS that choke small fishing lakes and interfere with the activities of an girrs can be eliminated with an ingenious weed sax now the east the spiral bladed flexible saw is attached by cables to an operating handle and dragged along the lake bottom from a said to a contract of the co



Dragged along the bottom the spral bladed sow cuts off weeds in the water



in a compact trailer an eighteen year old cyclist of Menominee Mich recently traceled nearly 1200 miles to Boston Mass economically and comfortably Post cards that he sold to currous spectators paid for his supplies during the fourteen day jour

ney Streamline in shape the sturdy trailer is a homemade product of bis own design He is shown above demonstrating his sleep ing quarters to an admiring hotel doorman

### Odd Coddie Cort Carries Golf Bag and Clubs

AN golfer can east ly be his own caddie with the introduction of a rolling carrier for a bag of clubs Towed by a handle as shown below the cart travels on rubber tired wheels that will not mar the greens



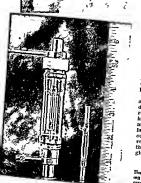
Here is a codd e that won't make w secrocks



### Spring Loops Hold Load on Bike Luggage Rack

A HAND new luggage carrier for bucycles makes it unnecessars to the or strap the load in place. Twen loops of spring metal automatically adjust themselves to hold securely a parcel of any ordinary shape or size as illustrated in the photograph above. A built in ref reflector button at the back for safety in night riding adds to the utility of the attachment.

## िर्णामिति विश्व Lamp जिनिह्य and Invisible



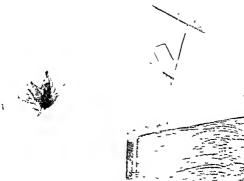
### By JOHN E. LODGE

ins affirm?

MELLS become visible, transparent gases take shape, heat and cold can be seen with the naked ow show the anamang scientific shad Electric Design staged at the General Fleteric Sound Soun

An accidental discovery, a few months ago, revealed with the little famp would do A quarter of a mile from the latch ratory in which will be found in a few find the latch ratory in which is a session, Dr. N. T. Gordon and has assistant, Dr. N. T. Gordon and has assistant, Dr. N. T. Gordon and has assistant and the lamp searchight per fine were trying searchight for the mage some in a new type reflector. Happening for grane up when the searchight was glare up when the searchight was glare in the direction of his laboratory.

The midget are lamp and its cooling water packet it is said to give out a light equal to a fith of the sun's surface brightness



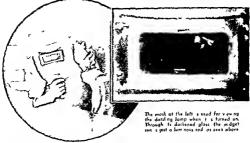
Dr N T Gordon holds a piece of plate glass in the beam of light Its shadow seen at the right shows circular pol ishing marks and other characteristics

Dr Gordon was surprised to see curious lines of light running through the glass of his windowpane. The rays, coming from a source almost as small as a pinpoint, were revealing unseen variations in the texture of the glass.

That observation started Dr. Gordon exploring the invisible by a new path. He installed one of the little lamps in his laboratory and projected the light across the room onto a white screen. When the powerful rays of the thry lamp pass through various liquids, gases and transparent solids, they are refracted, or bent, just enough to throw a shadow on the white screen.

Such shadows, looking a great deal like X-ray pettures reveal the invasible in a wide variety of forms During a recent vasit to Dr. Gordon's laboratory I watched him rub his hands together and then hold them in the path of the light. On the screen appeared the shadow of livisible heated vapor rising from his fingers. He uncorked a bottle of perfume and I could see rising above it, a faint cloudike image the shadow of a smell. From a pitcher Dr. Gordon poured heaver-than air carbon dioude gas and on the screen I saw it billow downward to envelop and extinguish a candle flame

When a glass jar of water was placed in the path of the light, I was able to watch chemical reactions and the mixing of colorless fluids Hydrochloric acid, poured Haw alcohol mixes with water as revealed by the magic shadows Unlike hydrochlaric acid which plunges to the bottom of a glass, alcohol remains near the surface.



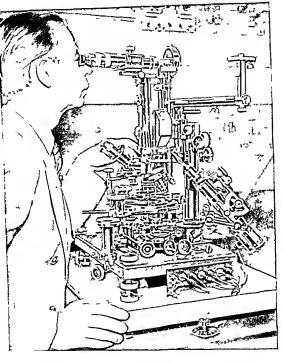
into the water plunged to the bottom and then mushroomed cut to ether side. Also hol on the other hand wairled about near the surface without descending When a pure of ice was placed in the jar a funnel of cooled descending water penetrated to the bottom Glass tuber rotated jub he path of the light produced patterns—some pland others formed of a series of parallel lines. The former had been twisted during manufacture the latter had been rolled. Other tests revealed other actrets of ghars. Dr. Gordon sees a practical application

for the technique he has developed in the testing and study of jissoware at factories. Another field where it may find underpread use is in taching. Through such scientific shadow shows students will be able to see with their own eyes chemical reactions and other scientific occurrences which intherio have been invisible.



Shodows point a picture of invisible carbon dioride gas pouring from a picher to put gat a concile flome. At the right a cold stream flows down tiom a lump of ice in a gat of water



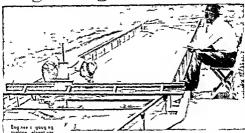


### Giant Microscope Explores New Worlds

RFPORTED to be so powerful that it reveals disease organisms never seen before the glant microscope pictured above has just been completed by Royal R Rife of San Diego Calif whose home built instruments have long been ranked among the finest in

the world To eliminate distortion the im age produced by the new two foot tail apparatus does not pass through the usual air filled tube but along an optical path of quartz blocks and prisms Weighing 200 pounds the microscope has 5682 parts

# Fighting Floods on



Enginee a gaugin surface elevation on the scale mode of the Las Angele Rvalin a city pa

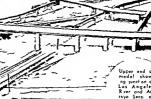
#### By C. W. WATERMAN

PRIDGE PIERS of notel streaml ne design will let river brooks rush smoothly past avering dangerous and costly vashouts How to shape them has been learned by U.S. Army engineers during a year of experiments with a 385 foot model of the Los Angeles R ver in Chifornia.

Accurately constructed to scale in one of the city's parks the model represents a four in le section of the river passing through metropohtan Los Angeles Along this stretch the treet bridges and trestles span the stream which is bordered by rs!



A map of the sect on of the r ver be ng stud ed Note many brdges



LABORATORY NEWS

POPULAR SCIENCE

## a Miniature River



Water pies up ago nst a common rounded per while siding quetly post a steamline and

road tracks on both sides A tributary the Arroyo Seco adds to the flood problem Both channels bone dry beds of sand for a part of the year seasonally carry vicious torrents from near by mountains to the sea. In the model artificial streams faithfully reproduce the seething currents in minature

Because obstructions in the stream determine the height for protective channel walls the engineers have concentrated their attention upon the forest of bridge pers in the district. On the upstream side of a spain the trouble is backwater—flood water that piles up first against the semicircular faces of the piers and then against the bridge itself often washing over it. This requires high channel walls to prevent over flow. At the downstream side of a bridge similar pier faces set up large waves top ping a bank that otherwise would be high enough

Simply by adding wedge shaped extensions to streamline both faces of a pier all three difficulties are eliminated the engineers have found. When a portable model of the novel fairing is held against a miniature hindge churning waters are magically quieted. With a wealth of such new data the engineers are developing a complete flood control plan for the upunity.

Robert Ma den m s ng chem cals to produce perfumes for sale

### Perfumes Help Pay Chemistry Fan's College Expenses

GETTING a college education is a matter of scents as well as of dollars and cents to Robert Maid en of Palo Alto Calif When he was casting about for a way to defray part of the cost of a bus ness course at Stanford Univer s to Maiden now a sonhomore decided to make capital of his hobby of chemistry He therefore worked out a selection of chemically produced perfumes which he now concocts himself for sale to campus co eds and to local shops. So successful has the senture become that Maiden may have hit on a full time money making career which will be in a thriving state by the time he puts his books aside at the end of his college course and starts in to earn a living

### Model Railway Gets Rolling Lift Bridge More than 30 000 mets were employed in the con

struction of the remarkable model railroad by dge pic tured below and at the right. Modeled after the Scherzer rolling I ft bridge that carries trains of the New York New Ha en and Hartford Ra troad across the Housa tonic River at Devon Conn the scale bridge represents three years of spare time work on the part of Alfred Schellbach of New Haven Coun Topping the scales at fifty eight pounds the span is thirty seven and a ball nches long the scale equivalent of 150 feet. The bridge has been put into service in the miniature rails ay sys tem of the New Haven Society of Model Engineers.



Two views of the model rolling ! bridge Counterweights to se t to open the span as Bust ated above

## Orchids on a Window Sill

HOBBYIST RAISES RARE TROPICAL FLOWERS



AN ORIGINAL investment of five dollars, months of painstaking care, and a generous sprinking of real ingenuity have made a success of Peter Robin's hobby of raising costly and delicate orchids on a window sill of his New York City apartment. Although professional

ect, Rolph, a restaurant manager, bought a single five-dollar plant as a starter less than two years ago. Now he has thirty-five healthy orched plants that insure, among them, at least one exquisite bloom at all times. So far, he has lost only a single plant.

Rolph knew that orchuds in their native tropical habitat thrive on an atmosphere high in mousture content. To assure the plants of sufficient humidity, he placed them in special pans of nonrusting metal and set them on top of a corner radiator grill Sheets of asbestos in the pans soak up and miniman the required

a corner radiator grill Sheels of asbestos in the pans soak up and maintain the required moisture, while thermometers and humidity gauges in each pan help Rolph Keep an accurate check on atmospheric conditions. A special oil-silk curtain masks the windows adjacent to the orchols to stilled them from the direct rays of the sur while still affording them the abundance of light they require

Containers used for the plants are ordinary flower pots In the bottom of each are placed some pieces of broken pottery covered with a layer of sphagnum moss. The loose pieces prevent the moss from pack ng down too tightly and also assure a free circulation of air around the

plant roots
Humdity is maintained
between forty and sixty
percent and the tempera
ture between seventy and
cipty degrees F When
ever humdity shows signs
of falling below the dan
ger point the hothysit
goes to work with a spray
foun full of were one of
Kohph belowes in the fact
that he gives constant and
unfailure attention to each

plant. Once a week he examines every plant leaf for signs of insect pests or hights of one kind or another. Each leaf is swabbed clean with a silk sponge and then the en tira plant is washed under a fine spray



In a number of the species that he grows the orchids may be propagated by subdividing. By removing the separate root growths and placing them in individual pots new plants are started as desired.

### Surfboards from P.S.M. Sail Swiss Lake



s seen under const uct on at left

### Twin Motors Run Giant Model Airplane

A GIANT in its class, a model airplane owned by Orin Anderson, of San Antonio, Tex, is propeited by twin motors placed one above the other Originally constructed by an airplane mechanic at the U S Army Air Corps training center at Kelly Field, Tex, the monoplane was designed to be controlled in the air by radio When that idea was abandoned Anderson acquired the ship in trade for model parts and now flies it as an or dinary model airplane with the controls fixed in one position







It takes two timy gosoline engines one mounted above the other to propel the oversize plane model shown in the oir of the right

### Jeweler Collects Finger Rings

COLLECTING old and rare finger rings is the interesting hobby of Charles Harris, a New York City neweler Among the many items in the collection are a bronze ring made for Napoleon Bonaparte from captured Russian cannon, a gold ring containing a

sharp steel knife blade that springs out at the touch of a button, and an ancient poison ring set with an emerald and two rubies The latter ring has a hollow band designed to contam a liquid poison Pushing one of the gems causes a poison-coated pin to jut out from the ring band Harris's father started the collection fifty years ago









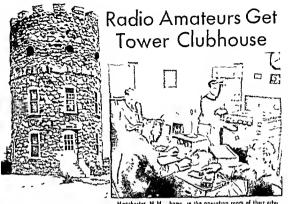




Rare old finger rings in the callection of Charles Harris, of New York City seen above examining a ring made for Napaleon Bonaparte from captured common. The ring in inset conceals a sharp steel blade

### Globe-Trotter Collects Curios





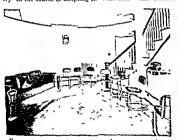
ONVERTED into an upto-date radio station, an

old stone observatory at Man chester, N H, now serves a threefold purpose As a public facility of the city its short wave outfit has been turned over to amateur radio enthusiasts, who have formed a cith to share its use If an energency such as a flood or hurricane cripples other communications the station will keep Man chester in touch with the rest of the country In the course of adapting the venerable

landmark for these practical purposes, it has been renovated and preserved as one of the city a historical points of interest. The first floor, attractively furnished as a reception room for visitors, also does duty as a clubroom for the radio 'hams." Their station with call letters WILIVIX, occupies the second floor Its powerful transmitter and receiver cover all amateur frequent

bands In case city power should fail a three-kulowatt, gasoline driven generator will operate the plant The top floor of the tower houses a workshop and experimental laboratory, and three sixty-foot poles, supporting an antenna, complete the installation

Built by a former governor of New Hampshire, the round tower was recently presented with its grounds to the city Public officials and learning citizens devised the novel plan of putting the relic to use, and their scheme was carried out with Government aid as a WPA project The elevenacer grounds surrounding the tower have been made into a public park.



The reception room on the ground floor also serves as a clubroom

### Tests on Frogs Show How Cancer Spreads



cells to the eyes of frogs Dr Baldwin Lucke University of Pennsylvania patholo gist has found a promising new way to atudy their growth in normal tissue Period ic observations and photographs through a powerful microscope clearly show the prog

ress of the disease in his animal patients. Resulting data may eventually prove useful in the treatment of human sufferers Al ready the tests are reported to have revealed well defined patterns previously unknown in the spread of cancer



DESIGNED to serve equal ly well in primitive or modern surroundings baby incubator of novel plan has been built by Na tional Youth Administra tion boys as a health proj ect for Chippena County Where current is available the chamber is beated with electricity regulated by a rheostat to give just the desired de gree of warmth in rural homes where electricity is lacking the incupator is kept warm by placing hot water bottles bot bricks or heated sandbags in a bottom drawer A ther mometer visible from the outside shows when it is time to renew the supply of heat.

### Arteries Sewed with Sugar Rods as Darning Eggs

Rops of sugar may serve as darning eggs for sewing to gether the ends of ruptured blood vessels one of the most delicate of surgical operations After fulfilling its purpose the sugar would harmlessly dis Proposed by Sidney Smith Jr University of Chi cago medical student method is reported to have proved successful la prelimi nary trials upon animals Be low Smith demonstrates his idea on a cut rubber tube



method of sawing up blood vessels



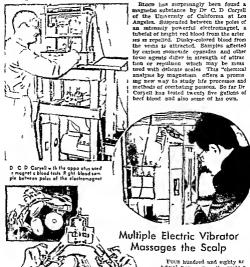
AFTER building seventy eight experimental machines to aid victims of infantile paralysis two brothers of Los Angeles Calif have perfected the electric exerciser shown above Legs and feet of the patient are strapped to pedals like those of a bicycle which are revolved in either direction by a reversible electric motor

### Odd Service Brings Movies to Patients

A WOMAN invalid s desire to see movies of the New York World s Fair suggested a popu lar and profitable serv ice to a New York mo tion picture operator Now he brings his pro rector to bedridden na tients entertaining them with film dramas or with travel pictures of places they would like to be able to visit For children his rener tory includes animated cartoons



### Magnetism Provides New Tests of Blood



FOUR hundred and eighty fir tificial fingers give the scalp a gentle and beneficial massage in a multiple electric vibrator just introduced. Light in weight, the appliance may easily be self manapolited as at left.

manupulated et at left, with the aid of two convenient hand grips while four uhrating disc do their work in unison. The machine is said to stimulate the circulation of blood to scalp and brain cells and to remove all dan

Using the new broter and to remove all dileast shows four disk druff and loose hair MEDICINE



PHOTO ELECTRIC cells are used in a new desire which is said to detect the approach of death by color changes in the skin

AUSTRALIA'S Great Barrier Reef bas an

SWALLOWING occurs involuntarily in his mans about once a minute

NINETY FIVE PERCENT of all the bathtubs in the world are in the United States





BEES roasted in oil and rubbed on the head once were thought to precent hair from turning gray

NATIONAL FORESTS comprise almost one tenth of all the land in the United States

REINDEER MILK is richest of elesen types listed by the U S Department of Agriculture



CURLING tendencies in papers are now measured by experts at the U.S. Bureau of Standards

EARTHWORMS have 900 brisiles on their bodies uith which to anchor themsels ex in the ground when birds try to terk them from their burrous





### Fish "Talks" on Radio

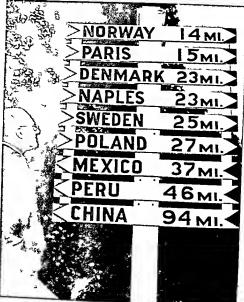
A TALKING CATFISII startled listeners to a recent broadcast from a New York City radio station. When removed from his tank in the Staten Island N Y zoo, the conversational catfish a native of the Amazon region of South America made currous sounds into the studio microphone as part of a natural bustory program.

#### Tree Serves as Cellar

MAINTAINING a temperature between forty and fifty degrees F the year round the bollow trunk of a huge maple tree serves as a frunt storage cellar for a Redmond, Wash family The tree cellar has room for 400 quart frunt jars



Preserved fruit is kept and in this hollow tree



## Signpost Scrambles Geography

ARE you as puzzled over the s gapost p c tured in the photograph above as is the somewhat maked gentleman shown giving it his und vided attention. The odd high way marker strange as it suppears is not be resulted at a map maker s n pitmare. It is an honest piece of work excited for the benefit of travelers along a metor road give

ing accurate informat on concerning the direction and the inlieage to the places named When the sign located? Pick a spot twenty three sign located? Pick as spot wenty three signs from Denmark and still only the type seems of from Mexico and you have your and of verup? Well, it as at Lynchville Me and he local itsel listed are all real Maine towns.

### Un-Natural History Gus Mager







A FISHS APPETITE SEEMS TO BE IN NO WAY AFFECTED BY ANYTHING AS TRIVIAL AS A HOOK OR TWO IN HIS MOUTH!



### Curtain Voses Hold Flowers

DIAPPERES orfamented with real flowers instead of forcil des gas, have been introduced by a New York interior descrator Pockets in lower folds of the curtains conceal test tubes filled with water into which cut blooms may be all peed as illustrated in the photograph above. The result is a gay fringe of blossoms to brighten a yourn with color

### Greaseless Liquid Waterproofs Cloth

POSITIVE waterproofing is claimed for a new highest proparation which according to the maker contains no grease or oil. Of special interest to continuous management of the continuous water of the continuous to the continuous to



Clathing can be water a cofed by rubbing to with a clathing stened in the new compound

### Funnel Treatment Inoculates Trees Against Disease

can now be inoculated against disease The new method em ploys a futurel that s placed around the trunk and filled with a chemical solut pn. When holes are bored in the tree s bark, the chemical mikgles with the sap The illustrat on at right shows how the method is used to prevent infection of a tree with the destructive Dutch elm disease or to kill any fun gus already there A major problem was how to make the funnel water tight. This was solved by I ning the base with a sheath of special material which fills the bark crevices to provide a leakproof seal,



### Newlyweds' Bungalow Costs Only \$2,650

DESIGNED especially for newlyweds a model bun galow erected with Fed eral and at Chester Pa. is the foreruner of hun dreds like it Costing only \$2650 the house can be bought with a down pay ment of \$150 and monthly payments of \$20 90 It has a good size living room shown in the photograph reproduced below two bedrooms kitchen bath and amplie closet space



Model home designed for young morried couples. It has an ample living room (left) two bedrooms kitchen and bath

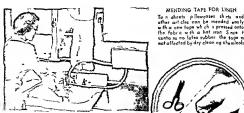
### Giant Wall Board Covers Whole Side of a Room

Wall board of gunt size so large that a single panel covers an entire wall without cracks or joints now is available for time saving dry built construction It comes swing try built construction It comes swooth placter surface the manufacture adds a size or primer so that it can quickly be finished after erection with one or two coats of paint

### Bulb Gives Bright Light

ELECTRIC LIGHT bulbs that give a brillmant white light are made possible by a new man utacturing process. Tmy were brushes mounted on the filaments enable the new lamp to operate at higher temperatures than ordinary bulbs without burning out as va porization takes place at the brush tips rather than in the filament.





other articles can be mended eastv with a new tape which is pressed onto the fabra with a hot iron Since t conto as no latex subber the tape is nat affected by dry clean ng chemicals

WATER OZONIZER. Top water that has unpleasant taste or odor a made palatable by an electric device connected to the faucet. When water is to red on pu fying ozone is generated and mixed with t



DEEP WELL COOKER Among the movel features of a new elect a range s a deep well cooker built into the range top as shown at upper left in one model the saguat cooker unt s set nto one of the lage utity d awe s of the range as seen above

TWO CLEANERS IN ONE We gling only f ve pounds the vacuum cleaner at the left can be held in the hand for dusting and smilar jobs Fitted into a special fame t walk efficiently on floor and corpets

Nine Handy Aid

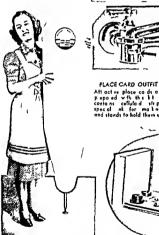
MOTH KILLER Eve y t me the closet door a closed a plunger n the fatu e below to ces ar th ough a perfo ated chambe to spay the nte a with a chemical that detays moths

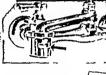


METAL IRONING BOARD Lifet me service is claimed for the a metal oning boad ! lustrated below Vents a the top so y off the excess steam



TRANSPARENT FURNITURE The bed and cho of a crystal clea plate that does not che split or stan

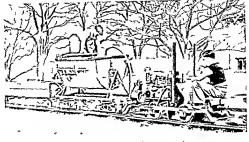








### or the Homes



### Orchard Railroad Aids Peach Grower

LEO HERMAN of Tallmedge Ohio started his 2500 foot electric railroad system as a hobby but now it helps him to care for an extens we peach orchard on a six acre tract eurrounding his home. An electric loco motive powered from a third rail haule the roling stock of four cars—two flat cars for carrying passengera tools and equip ment one specially built to haul aprey hose and a tank car for the liquid spray



### Moth Trap Lures Pests

INSTRAO of em titing an odor umpleasant in moths and merely divruing them to an other spot, a new moth trap tures the ctoth destroying insects to their death. Chipped to a clothes hanger the cardboard trap provides a convenient nest with food for the moths A chemical in the trap kills roths larves and eggs

### New Concentrated Soup Is Easy To Prepare

DELICIOUS soups are now available to house we no convenient concentrated form. The concentrate is removed from its package crumpled and dropped into a quart of boil nig water as abown below. In a few minutes a testy and nourishing coup is ready to serve



Crumbling concent ated soup into boiling water



When laaking straight ahead haw well do you zee to a ther side? With a per meter the seated man s having this vital factor to good diving measured



A hearing test. The some volunteer is followed through out most of the pictures on this and the next page. He else response to sounds of vorying intensity is checked.

# Odd Driving Tests

### SEEK THE CAUSES OF AUTO ACCIDENTS

HAT are the real causes of auto mobile accidents. In an attempt to shed further light on this com plex problem the Center for Safety Education of New York University in cooperation with the State Motor, which Eureau and

the Greater New Nork Safety Council recently inaugurated an elaborate series of special tests for volunteer groups of metro politan drivers

Twenty five automobile operators each of whom had driven at least 50000 miles in the metropolitan area during the last five years without a single accident form the first group tested while a second group of twenty five were picked from those who in the same five year period had been in



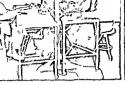
In the dual cont of ear of left rood tests show up his skill or lack of t

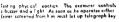
The divernow locks of a braht light sos de of an adaptometer. Tempararly blinded he must be able to see normally again with no specified it me

Agon the diversieves are tested this time for vision under voicus light intensities ta learn whether or not he is subject to any night blindness











Timing of the divers reaction speed as tested at the left is done by the esaminer with this apparafus which measures delays to ane 300th of a second



volved in at least four accidents one of which cacuterits one of which cacuted within the last two years. By puting both groups through an extensive series of laboratory and actual driving tests the researchers under the direction of DT Leon Brody, of New York University, hope to be had by the property of the propert

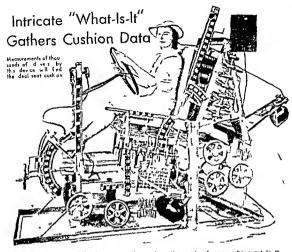
To show muscular reactions driver holds his left foot behind him with his right hand as he hops through intricate system of squares In specially equipped laboratory rooms each diver is tested for blood pressure muscular coordinator speed of reaction to sound and light vision and muscular con trol of the eyes and other physical factors. An impressive array of instruments in cluding a dynamometr, manoploscope adaptometer, and other scientific measuring instruments is employed

anstruments is employed
In a second group of tests, the subjects
In a second group of tests, the subject
and control automobiles for actual circum gours
An accompanying observer rates the car
operators driving ability with the sid of a
scale chart designed expressly for the yeur
pose. The third part of the compilet test
series involves written examinations given
to check on matters of the subjects perto check on matters of the subjects peron that more continued to the compilete of
the principles and practices that contribute
toward making a person a good driver

Yesting a driver on the road. Given o driving cam mand he waits to obey if until the examiner flashes o dash light. His reaction time is agoin recorded Brief fluctuations in blood pressure orising from variaus driving experiences are measured as below with a delicate device called a sphygmomanameter

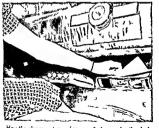






No its not a car of the future nor the past either. The strange looking con traption in which the young woman seems to be going for a drive is designed to gather information for engineers. Installed at the University of Michigan at Ann Arbor

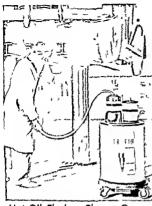
where thousands of persons have sat in it, the apparatus was built for a cushion man ufacturer who hopes from countless meas urements made on it to obtain an average size automobile seat cushion that will be comfortable for the majority of motorists.



How the cleans ng t ssue d spenser fastons under the dash

### Dash Dispenser for Cleansing Tissue

FACE CLEANSING tissues ideally suited for immunerable driving uses are stored in a convenient dispenser which fits under the glove compart ment of the dashboard of one new model car. Finished to match the mixturnent panel the dispenser is offered as an inexpensive optional accessory to buyers. The tissues are handy for dusting and polishing win down steering wheels and instruments. They also are a convenience as emergency handkerchiefs for sufferers from colds and hay fever and other motoring needs.



### Spark Plug with Skirts Prevents Short Circuits

Lowest trouble free hif is claimed for a new spark plate to at makers the first major ad vance in plug construction is more than a decade Taiking tis cue from the skurted insula tors that carry cross country high tension wires the porte fain insulator steve of the minimum control of the tension with the control of dirt and grease and in crease surface area lessening the chance of short circuits.

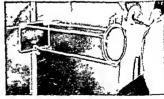


### Hot-Oil Flusher Cleans Gears

MOUNTED on casters an oil heating and pumping mach ne for garage use flushes automobile transmissions rear ends and crankcases with a flow of thin oil heated to 220 degrees F to remove all traces of dirt sticky sludge and metallic fragments. Oil pumped by the device is sucked back again to boost the cleaning process

### Headlight Aimer Saves Time and Space

AN OPTICAL TYPE head hight aimer using a reducing lens to focus the light beam on a midget call brated screen saves both space and working time Usually carlght testing jobs require up to twenty five feet of clear space and a large target. The new instrument requires only four feet in front of a car Sultable for any type of headlight the device per mits both vertical and hor izontal adjustment It is also available with a light intensity meter



Four feet of space sested of twenty five suffice for this tester

Jumbo Suit Case Shows Size of Sedan's Luggage Space

To SHOW dramatically the size of the lug gage compartment in their sedans the Hud son Motor Car Company built the jumbo suit case being eyed with evident dismay by the porter at the right. Nearly h ding the







If the cars luggage com



### Meter Helps Car Driver Cut Fuel Consumption

How to press the foot accelerator of your car for the greatest gasoline economy un der all cond tions of driving is indicated in stantly by the meter shown above Easy to install on the dash or to fasten in place by a windshield mold ng screw the instrument has a pointer which indicates whether gaso line consumption is low medium or high By observing when the consumption is high a driver can keep from wasting gasoline The device also indicates the proper fuel consumption for coasting and idling as a check on motor adjustment

#### Handy Brush and Cleaner for White-Wall Tires

FREE of any bleaching agent or ingredi ents harmful to rubber a new preparation just placed on the market for motorists re moves dirt grease and scuff marks from white walled tires at the same time that it applies a fresh white coating. The manufacturer claims that the finish will neither crack nor peel off The compound is packed in thirteen ounce tins as shown in the il lustration reproduced below and a special cleaning brush with a convenient handle and fine brass wire bristles comes with it.

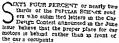


shand cleaner set to keep white tires spotless

### Auto Contest Winners

POPULAR SCIENCE READERS
AIR THEIR "PET IDEAS"
ON THE CAR OF TOMORROW

•



Added to this startling majority is the preference of forty percent of the contestants for a car of functionally stream line "teardrop design."

In each of the percentages given the figures represent nearly a unanimous opin

FIRST PRIZE, \$50 Wyott Brumm tt Pitsford N Y

SECOND PRIZE, \$25 Hermon Schepler Dubuque Jowa

THIRD PRIZE, \$15 W H Kndel Pueblo Colo

FOURTH PRIZE, \$10
Floyd Milton Worthington Minn

#### HONORABLE MENTION

Ci fio d Blanke Los Angeles Co I Den W Byes M nneepes , M nn Andrew P Exche Delana Col I P McCo nr. Henry feat Fe s Charlo Vo J Melen at Winnepeg Monu, Canada Grad C. Rand Konsos C Y Ma Robert P Soone Rocherte JJ, Y J Raph G Young AD Long Seach Co.



ion of all who expressed their ideas on those points with scarcely a handful oppound such drastic changes

From humper to bumper cars of the peak, present and future were appraised by the entrants in thotal war the winners of which, along with those of which along with those of the peak for the most part, the writers agreed that cars should not he larger lest they outgrow printed garages and, as one pointed out, it a easier to change America's cars than her garages.

A teardrop ear incorporating the various does surgested by the many contestants would have an underside as smooth as the rest of the body and windows of transparent plastic would be flush with the body statement of the plastic would be flush with the body statement of the plastic word one piece metal reconcered plastic word one piece metal reconsistency of the plastic word of the piece of

Many letters approved disorescent light his post inside and out, with all exterior lights recessed in the body and fenders Studing doors controlled by push buttons would replace the hinged doors of today. The drivers such holding two or more provide would be close to the wide unob period with the control of the control



### Mechanic's Stethoscope Diagnoses Auto Ills

RESEMBLING a doctor's stethoscope handy new tool enables the automobile mechanic to diagnose car ills Consisting of a length of rod and rubber tubes leading to earpieces the device is pressed against a spot on a motor clutch transmission or rear end near where the trouble is thought to be It quickly locates knocks and squeaks

### Cleaner Takes Bug Stains from Automobile Finish

LATE SUMMER drivers will welcome the cleaning compound shown in use in the picture below for cleaning dried bugs and bug stams from the fenders radiator grilles windshields windshield frames and other parts of the car It contains a chemical com pound that reacts quickly on bugs without harming the car finish. To use the cleaner the surface to be cleaned is first wet with water The powder is then sprinkled from its shaker top can on the stained area rubbed with a damp cloth and rinsed off



### Owner Builds Working Model of His Car



Two apprecative experts—G B Allen chef enginee and A H Fres assistant chief engneer of the Dodge Dyton Chrysler Cor po at on- aspect ag the scale model coupe

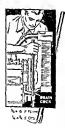
REPRODUCING practically all operat ing parts with such precision that they function perfectly the model of a popular stock model coups shown in the accompanying photographs was copied from his own car recently by Philip Johnson, of Vermillion Dak Individual front springs clutch brakes gearshift engine fan venti lators windows hood and doors all opérate realistically

## REPAIR STUNTS



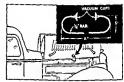
Stool Gives a Lift for Cleaning Top of Auto

> on the running board of your car while washing or polishing the top you'll appreciate the usefulness of the stool shown in the accompanying sketch. It can be made easily from a few pieces of wood the dimen sions of which are suggested in the drawing. The length of the legs of the atool should be determined by the height of your running board and your own height. Be sure to make it high enough to allow you to reach a little more than balf way across the car top from either side without stretching



#### Slotted Pipe Easily Opens Radiator Drain

RADIATOR drain ng is made easy with a section of 3," pipe 16 long and slotted at one end as shown at the left. The p pe is easy to lower over the usually mac cessible petcock to open of shut it It will save scratched hands and spotted sleeves-to say noth ing oftenpers -- V C



#### Bracket Holds Both Sides of Car Hood at Once

It is often necessary to hold up both sides of an old style car hood while doing minor repair jobs but they will not always stay put A useful holder can be made from a 14" pipe or rod and two good-quality vacuum cups Bend the rod as shown. At tach a vacuum cup to each end of the rod The distance between them depends upon the car but usually about 18" is sufficient. To attach fasten the vacuum cups on the lower edges of the hood covers with the rod under the covers as shown in the illus tration above -E. B

#### Tire Dust Caps from Erasers

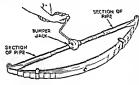
RUBBER erasers of the type made to slip over the end of a pencil make handy dust caps for tire valve stems and save time when you stop for air -



## For CAR OWNERS

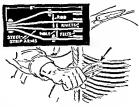
#### Tool Cleans Car's Grille Two Strips at a Time

THE little time it takes to make the device illustrated at the right will be well repaid by the speed with which it polishes close spaced radiator grille strips Soft countersunk rivets will hold the felt pads permanently in place but good rubber cement may be substituted Spacing of the laws is determined by your grille strips Squeezing the device causes each pair of pads to close on a separate strip -F G



#### Jack Spreads Springs

SPREADING a car spring so that the sbackle bolts will slip into place can be done easily with a bumper jack and two pieces of pipe Hammer one end of each pipe flat and place the pieces over the ends of the jack as shown The outfit easily spreads a spring to the desired point.-J H



#### Easily Made Die Clears Damaged Axle Thread

With removing rear wheels the axle threads sometimes become damaged An easily made die to clear them may be made by cut ting in half a spare nut of the same thread as shown at the right and clamping the halves over the undam aged thread with a mankey wrench halves are then screwed off over the damaged thread thereby clear-ing them -S A T



#### Trouble-Lamp Outlet for Luggage Trunk



OF FEAL service during nighttime repairs particularly on the road is a trouble light outlet such as the one shown mounted in some convenient spot in the luggage compartment. Connected by rubber insulated wire to the hot terminal of the horn or ammeter and to ground the outlet is a conventional wall type unit such as is used in homes. In place of a house current hulb in the trouble iamp one of six volts is substituted The jamp cord should be long enough to reach any point on the car, so that you will not be caught short in any emergency -A M

## Gus Beats the Heat

HE afternoon was sunny and hot and for once there weren't any jobs stand ing in the shop wa ting to be worked on So Gus Wilson sitting in the shade of the 1ttle porch outside the office was taking t easy and watching the cars go by The suburban town Model Garage which Gus and his partner Joe Clark have built into a satisfactorily properous bus ness stands on a main road at the foot of a slope Gus had just filled and lighted his second after lunch pipe when he heard an engine sputter and quit and saw a well shared up sedan stop at the beginning of the upgrade

A fat man wriggled out from under the steering wheel and an equally fat and very flustered looking woman moved over into the driver's seat. The man walked wearily around to the rear end of the car took the cap off the gas tank chehed up on the humber shouted something to the woman and then blew gustily into the tank The car began to move aga n slowly and

sounded I ke a burst from a machine gun The man on the bumper continued to blow into the tank

Suddenly the woman who was draving made a U turn As soon as its nose was pointed downhill the sedan's engine took hold and ran smoothly. The car turned in at the driveway and stopped at the gas pump The man got heavily down from his perch on the bumper and demanded to know what was the big idea

Ive had enough of this the stout woman told him dangerously Im tellin you George-get st fixed

The man puffed out his cheeks-they were purple from his blowing-and glared at her I suppose you think I like it he said bitterly Then he turned to Gus Namea George Hawkins-thie is Mrs Hawkins Live up in Rhode Island Wese had this car for four years and until day before yesterday we never had any trouble to amount to anything with it Then it went

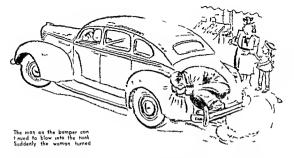
level but acted like the gas line was clouded every time she tried to go up a hill We were start ing on our vacation trip yesterday morn ing so that night I took the bus to a garage and had it gone over They checked the carbu retor and fuel pump and blew out the gas hne and told me I wouldn't have any thing to worry about Aln t that right Estelle ?

Estelle snorted Gus couldn't make out whether she was reg stering agreement or disgust Her hus band swallowed nerv ously and went on with his tale of woe

We started out yesterday morning and for fifty miles or so things went all right. The car didn't have as much pep as usual but we didn't



Hairy shifted the lever into reverse and again left out the clutch. Dieg nosis Shaif arout "Gussad. Where? And why? Dr. Foley demanded



have any real trouble Then we got into the Connecticut bills and—ob boy Every time we tried to go up a grade the car acted like it had a bad case of vapor lock if the bill was at all steep the motor would quit dead. After a while I got the idea that if I biew into the gas tank it would force a little gas into the carburetor That worked well enough to keep the bus going but before long I was darned sorry I d ever thought of if. Every time we hit a hill Id have to climb out on the back bumper and blow my lungs out?

We called it a day early in the after noon and I took the car to a small town garage Sure the feller there said it was avapor lock and he knew how to fix it He put in a new gas line from the fuel pump to the carburetor keeping it well sway from the inamfold. He charged me plenty for the job but be told me it wouldn't have abad all day today and I'm sick and tured of sitting out there on the bumper blowing my heart out and listening to a lot of smart guys make wiscernicks.

And I'm sick and tired

of this whole fool trip and of everything about it his wife put in grimly Fix this car up so we can get home Mister and I swear Ill never set foot in it again

I don't blame either of you for being disgusted Gus told them managing to keep his face straight There's nothing that il spoil a vacation trip quicker than a balky car But if you'll drive into the shop I think I can fix up your trouble for you

As Mrs Hawkins drove into the shop her husband followed Gus Make it good, Mister he begged Eatelles plenty sore and if you fall down she il sure give me hell

You'll be a lot more comfortable waiting in the office Mrs Hawkins Gus told the peevish lady as he held the door open for her When she had vanished in sultry stlence he got into the car and stepped on the starter The engine took off but its sound told Gus that it wasn't getting enough gas
Leaving it running at moderate speed

Gus got out raised the hood and examined the fuel pump and carburetor. The fuel pump is pumping scarcely any gas he remarked. The main gas line has been checked twice so it a pretty certain to be OR. He leaned over and eyed the rubber hose connecting the gas line and the pump then took it off. This might be the joker he said. Attaching an air line to the hose

and holding a swarthy thumb over the other end he lowered it into a pan of water Dozens of little bubbles formed on the hose and came to the sur face That a your trouble maker he decided

He examined the hose closely then handed it have this. There are several small holes in it he told him. See what seen happening? Gas hasn t been leaking out of

Use Your Head Instead of Your Hands And You'll Keep Cool In Any Kind of Weather

By MARTIN BUNN

the hose. If it had been the mechanics who have worked on your job would have located the trouble Instead of that air has been sucked in through those holes As you drove uphill the suction was stronger than it was on the level and so much air got into the mixture that it killed your engine When you bles into the tank-that's a new one on me-it forced more gas into the fuel lpe and that kept your engine running Easy to fix just a

length of new hose Five minutes later Hawkins went into the office and then came out with his She listened wife grimly to Guss ex planation of the cause of the trouble and as grimly to the smooth bum of the engine Then she got heavily into the car

I hope you have a pleasant trip home Mrs Hawkins Gus

ventured with a grin For the first t me she smiled I guess as long as we've had all this trouble coming down here she said we might as well visit my sister in the city She looked at her hushand and her face grew gram again Get in George she anapped Don t stand there wasting the rest of the day

Gus watched them drive away thanking his stars-not for the first time-that he had remained a bachelor. Then just as be was heading for the cool office porch Dr Foley drove up to the shop door Cus he greeted Busy?

No Doe Gus said Just dog lazy It s the weather the doctor said May be that's what's the matter with my car too I can't think of snything else It runs fine going ahead but the motor dies every time I put it in reverse. Diagnose that case

Not until I've examined the patient Doe Gus said grinning "It wouldn't be professional it would make it seem too easy locknow that. Drive her in please On Friend thouse into the shop Jat's up the rear end will you? Gus asked Harry

the grease monkey Probably something has gone wrong with its appendix, or maybe its tonsils he told the doctor But a routine check beneath the car

falled to disclose anything wrong

Hub Gus grunted Well, Ill give her a road test He was back inside a quarter bour Just

as you said Doe he rem ked as he got out. Runs swell going forward and goes

dead every time you go into reverse. Guess Ill have to do a job of trouble shooting Get the rear end tacked up again Harry

Harry jacked up the rear wheels. Gus raised the bood and relighted his pipe Get in he told Harry and step on the starter The engine started promptly and ran succetly Now put her in reverse he directed

Harry did as he was told and let out the

clutch Guss quick eve saw a spark at the rear of the engine fust before it stopped He peered in then put his hand in and moved something Start her again he said Now put her in reverse Harry shifted the lever into the reverse position, and again let out the clutch The engine continued to

run smoothly Diagnosis Short circuit Gus said

Short circuit? Where? And why? Dr Foley demanded Here's the low down on your trouble Gus explained Your engine is mounted on rubber and it moves on its mountings When the car is moving forward the engine settles down on the mountings. But when you go into reverse the forward end of the engine seems to be raised a little by the torque and its rear end settles back a little Now the primary wars to the distributor passes through a narrow space between the dash and the oil filler pipe When I saw a spark there when Harry reversed I knew what had happened—that the movement of the engine on its mountings had chafed through the insulation of the distributor ware just behind the filler pipe When the car was moung forward and the engine settled down on its mountings nothing happened But every time you went into reverse the changing position of the engine squeezed that have spot on the distributor wire between the filler pipe and the dash That caused a short circuit which killed your engine Fix it up Harry "

Dr Foley drove away and Gus went back to the office porch Joe Clark looked up from a ledger from a ledger Nothing in the shop? Nothing much Gus told him. Just a

couple of those little things that are hard to find and easy to fix. Nothing in them Joe said gloomly

Cus laughed Sure there is he said Not much profit but they re swell jobs for a hot day-they keep the old bean working and don't make you sweat too much

will you Gus?

GUS SAYS:

Don't let a raut of your tres on a

long trip because they've gained

pressure from heat. They won t

gan enough pressure to do any

harm And letting or out will only

make them get halter when you

resume your journey because

they Il flex more



Below the first

opening though
the waif of the
secret doo unless
the e is a cady
a doo in the de
is ed position. If
so the bookcase
may be added to it
without difficulty





So attractive is this bookcase it would fempt almost anyone to step up and examine the titles yet it isn't a case and hasn't any books. Instead it is a secret door leading to another room

# This Bookcase



At left fiting the week trame which was made from which pine Below file wood fit pa for around the door and to an total "thelves" were sounded to seen it chass by clomping a wooden gude block to the bed of the tander

ECRET doors suggesting mystery and intrigue are interesting to every one it is not necessary to have a valid though two can readily be found One is that they can be made more ornamental than a plain door the other is that they provide a legitlmate means of surprising and amusing referred and visitors.

This secret door which was built into a wall of the witters office appears to a wall of the witters office appears to be a well stocked bookease but when a button is pressed if opens silently, into an adjoining workshop and studio. The effect has proved particularly gratifying when the door is opened at the moment a visitor is reading the silles of the books.

An opening about 35 wide and "4 high was made in the wall and 12 wide pine boards were cut to make a frame. Most of the extra width of the frame was allowed to project from the wall to form the book case.

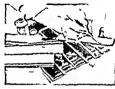
A piece of '-" plywood (3," would be still better) was cut to fit loosely made the frame Wood strips about 3," square were glued to the face of the plywood door around the edge to form a rim Other strips of the same thickness but 2," wate were glued across the door to look like the edges of the she they

As it is difficult to obtain enough old books that may be mutilated for this purpose it is best to purchase imitation book backs from either a furniture dealer or a book seller They are commonly supplied to deal ers by bookcase manufacturers in order to dress on their products when on display

If the backs are in strips they may be glued directly between the shelving strips on the door otherwise they should first be glued individually to strips of plywood of the proper width and thickness A space should be left at the bottom of the door

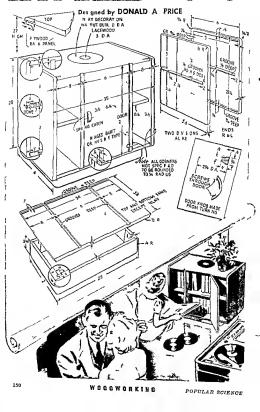
for an imitation drawer front of plywood When the door has been completed and hung with butt hinges any suitable molding may be nailed around the front edge of the frame to conceal the junction of the door and the frame. The exposed wood parts may be stained and warmheld or campled

Fit a spring at the back to open the door and in the frame install an electric door opener which may be purchased from any well streeted electrical douber.



149

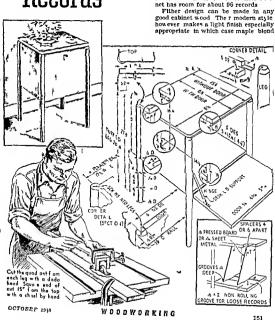




## TWO-MODERN Cabinets TO HOLD YOUR Phonograph Records

O GREAT is the popularity of re corded music that it has become s problem in many homes to find a suitable place to keep the rapid by prouring accumulation of phonograph records The best solution is to provide a cabinet especially designed to hold standard record albums

Two designs are suggested in the accompanying illustrations. The first is a loving family that expects to build up a large collection of records It has a capacity of about 380 records in albums The compartments may be subdivided if desired with spacers 4 or 6" apart to keep the records or albums upright as shown in a detail. The smaller cabi

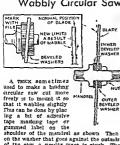


walnut or birch may be used as desired The design of the larger cabinet mini mizes the trouble to be expected from shrinkage as the grain of the principal parts runs in one direction Because of this the use of solid wood is permissible al though the wide boards should be glued up from three or four parrow strips to counter act warping. This piece is well adapted for veneering and inlaying and the top can be inlaid if desired with a 10" disk of walnut burl and a 3" diameter lacewood center representing a phonograph record

The door can be hung with ordinary butt hinges or hinges of the invisible type It is held shut with a spring bullet catch. In building the smaller cabinet the box should be constructed as a unit and the legs then glued and screwed in place. The top is secured by screws which pass up through the strips at front and back and by two metal angles on each side. If the back is to be exposed glue and brad on strips 1/4" by %" at top and bottom of rear panel Various modifications can be made of

these designs such as omitting the doors

#### Wabbly Circular Saw Cuts Without Binding



of the saw a similar piece is stuck. The washer is adjusted so that its high spot is diametrically opposite that on the mandrel. As a result the saw wabbles slightly when running thus cutting a wider slot This treatment is particularly helpful

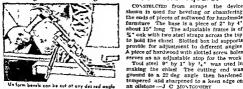
with hollow ground or planer type sams



emergency use and for fairly light cutting A better way is to machine a pair of washers or spacers each having one sur-face at a very slight angle with the other

These are marked so that their beveled sur faces can be placed in the same plane Pres sure on the saw is then uniform and there is less danger that uneven stresses will be set up Saws having such a wahhling fea ture built into them are on the market

#### Jia for Trimmina Ends of Furniture Squares



the ends of pieces of softwood for handmade furniture The base is a piece of 2" by 4" about 15" long The adjustable frame is of %" oak with two steel straps across the top to hold the chisel Slotted box hd supports provide for adjustment to different angles A piece of hardwood with slotted screw holes serves as an adjustable stop for the work

CONSTRUCTED from scraps the device

Tool steel 9" by 1" by 1," was used in making the chisel The cutting end was ground to a 22 deg angle then hardened tempered and sharpened to a keen edge on an oilstone .- J C MONTGOMERY

#### Support for Long Boards Being Planed by Hand

Among the various supports used for holding the end of long hoards while being planed at the bench one of the simplest and most convenient is that illustrated A series

most convenient is that:
of steps are cut out of
the upright plece to
permit wide work to he
held level at different
heights The dimensions
given can he altered to
suit individual needs

When using a step ladder for repair work tools and materials may be placed on the top step if strips of % by 1" wood are nailed or screwed around the edge to form a tray. The strips will not prevent stepping on the top step when necessary.





Steps cut in the upright piece allow wide work to be held level at different heights.

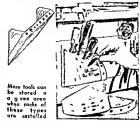
#### Cork Facing Improves Metal Sanding Disk

IF A SANDING disk is faced with cork the garnet or aluminum oxide paper will last considerably longer A roll of 1/16" or is, thick cork may be obtained from a insal order house or craft supply shop Brush casein glue on both the cork and the metal disk apply pressure and leave to dry over might If the sanding disk happens to be a little out of true use is," cork so that it can be turned true after being glued

Rubber cement is used to fasten the abrasive paper to the cork Apply a coat to both surfaces let dry five minutes or more, apply a second coat to the cork surface and again let it dry Then press the disk against the cork surface—Eric L. Buss

#### Handy Racks for Punches and Other Small Tools

OND of the commonest racks for tools such as punches and acrew drivers consists of a strip of wood with holes bored at intervals along one edge. Instead of mounting such racks flat till their upper edges out ward so the tools can be inserted and extracted at a convenient angle or bore holes in a series of segments out from circular disks and mounted side by side. Each segment should cover about 60 deg of arc with holes spaced every 10 or 15 deg.



# Economical TO-MAKE ONE MOTOR

By EDWIN M. LOVE

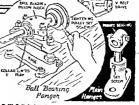
MACHINE is an individualist instally giving the best when driven by its own motor A flip of the switch and the lattle work.

work.

With the possible exception of a circular saw and jointer combined in one drive the maximum output and conventence are achieved in the home lence are achieved in the home to each machine. All a stable to each machine All a stable power in the motor is delivered to the pulley with none wasted in belts and bearings along the line staft. There are no belts to be removed or replaced, and no beary motor to be dragged from one power tool to another

In actual practice however many home workers have to make one motor serve for several machines. It is sometimes argued, in fact, that a line shaft is an advantage because one powerful motor can be used instead of several small ones thus saving on the purchase price and speeding up

ROBERT JAACKS WHO IS EQUIPPING In home workings as a muchly budget of \$15 checks the speed of h as cell sow the property of the self sow at 100 se



## **Workshop Layouts**

### DO THE WORK OF TWO OR MO

n sk

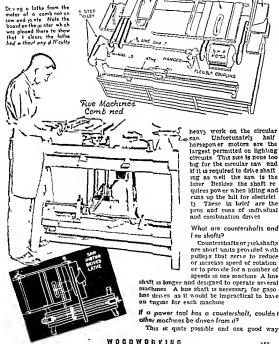
CIRCULAR SAW (TILT NG ARSOR)

JO NTER

At the right is a space

soving loyout of five

on a bench top 44 by 56



to economize with motors. Most wood turning lather can be fitted with countershafts in fact, they must be if metal turning is to

The draw for the latte will also operate a seroil saw or a band saw or both The a seroil saw or a band saw or both The and the latter of the latter with a bet if rect from the shaft or a shorter belt from the headstock may be used if very large faceplate turning is often done at the lett end of the lathe head stock t would be wuse to have a bett long enough to permit the saw to stand entirely clear of the latter back or behind the latter to obta n suffice ent same

The machines could be assembled on a bench wide enough to take all or on one but in T or L shape. It is easy to mount the lathe low enough so that it wall not obstruct long or wide lumber being worked on the saws. An example of how a lathe can be placed in such an arrangement is shown on the preceding page.

The higher powered circular saw motor can drive a lathe as well as a pointer Stand the lathe at well as a pointer Stand the lathe at the hack of the saw belting its countershaft to the motor. For cutting very wide stock on the saw the headstock of the lather mist be removed which is easy if a lather mist be removed which is easy if a lather mist be removed which is easy if a that end is made. The lather could also be pulled endwise to clear wide stock.

How may more machines be arranged for driving from one motor?

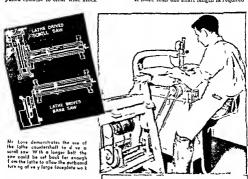
Haiford R. Thomas of Alhambra Califhas an ingenious set up of six machinemounted on an old washing machine hase Casters allow the group to be pushed around as desired so that long hoards heing cut on the saws can be steered through the door

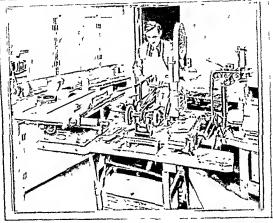
Another good arrangement which combined five standard size machines Is shown in a drawing on a preceding page. These are all mounted on a Dench top about 44 'by 56'. The motor is connected directly to the 11c shaft but a little change would allow the use of a longer shaft belied to the motor guing additional speed at a little more cost and permitting the saw and jointer to be used without need of driving the shaft!

#### Is shafting difficult to install?

No the untailation is fairly easy A length of shaft will act as a transpitedge Sign on the needed hangers prop the shaft as position and acrew the hangers in place bringing the bases to a time Tighten the set seems for the height adjustment of the end to be seen to be sufficient to the second of the base to a hard with the fingers and try the shaft with the fingers and try the shaft with the fingers are sufficient to the second of t

If more than one shaft length is required





In Holford R Thomas' shap a single mater drives circular saw scroll saw band saw drill press jainter, grinder

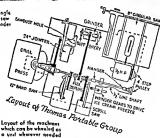
use a coupling preferably a flexible one which will take care of slight misalignments Use clamp-on collars to limit end play

What do shafting and accessories cost?

Shafting ground true can be bought for as little as shout 12 cents a foot for ½ diameter in 24 lengths suitable for diring light machines. For heavy work, use ¾, costing around 25 cents a foot Solid couplings in these sizes are 18 and 29 cents up, and flexible

rubber-cushioned couplings 25 and 40 cents Bronze hushed hangers are around 90 cents and \$115 self-aligning ball bearing hangers, \( \frac{h}{a} \), about \$470 Bronze bushings need fracequent oiling, ball bearings require only occasional oiling and waste less power

V-belts are used almost exclusively in the home shop In general, they are more ef-



ficient and less wearing on the bearings than are first helts. They cost as little as cent an inch for widths of ½. Fulleys are available in many sizes and prices, and are either die cast or pressed from sheet steel Most of them are locked on the shart with sect access, although in larger sizes keys are often used With such a choice of pulse often used.

s zes and belt lengths machines can be run at any chosen speed and placed wherever desired

#### Can countershafts be used vertically?

Ves if equipped with ball thrust bearings to carry and loads Such arrangements can be used for dr ving drill presses and shapers but they must be mounted on rigid uprights. To be driven from hor zontal shafts they must be equipped with miter gears or with a belt bent over a pair of pulleys to bring the belt hori zontal. The expense and trouble involved usu ally offset any saving effected by not buying a motor

#### How are pulley sizes fraured?

Roughly rotation is proportional to diameter A 2 bulley turns about twice as fast as a 4 nulley belted to it. For more accurate figures subtract the thickness of the V belt from the

pulley diameters since the belt bends near the center of the th ckness. There is a little warra t on due to belt tens on speed and load

V belts need not be drawn tight as they grip with a wedging act on that mereases according to load

If a truck and handles m made as shown be t s an easy matter to chiff the mach nes as reau red for yor ous jobs 443 CARRIAGE BOLT

(TO BE CONTINUED)

#### Hand Grinder Used on Scroll Saw for Shaping



DY CLAMPING it to the saw sleeve of your scroll saw a small high speed band grinder can be mounted for delicate shaping routing sanding and the like The aize of the plywood bracket for attaching the grinder will vary but approximate dimensione are given The two main clamps are cut from \$5" five ply wood al lowance being made for the thin rubber that is glued to the gripping surfaces. Two metal or plywood connec tors are drilled for a "4" bolt and are screwed to the clamp plates A wing nut locke the unit in place

A two piece wooden guide fence is clamped to the saw table. If a small section of the fence is cut away it will allow for the cutter when lowered Vertical ad justments can be made either with the tension adjust ment screw or by moving the bracket itself. A slight





WOODWORKING

is attached to the table POPULAR SCIENCE



Unbleached muslin patches are applied with roofing point over all spots that have been cemented

BY RALPH G. WARING

IN roofs, which are frequently found on old houses and other buildings will last atmost indefinitely if properly maintained. The roof illustrated above was lad in 1868 and should be good for another quarter of a century at least

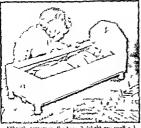
Roofs should be regularly inspected in the fall and spring. When it is necessary to refinish a fun root, all seams, especially of the flat type, should be scratch brushed and scraped clean and free of scaled, blistered, or cracked paint. The rough edges should be feathered down with coarse gandpaper to the clean metal. These areas should be immediately printed with a rust-inhibitive (preventing) paint and allowed to dry twenty-four hours.

If a nail has worked its way up through the metal here and there, it should be driven down with a large nail set Level off the holes with marine deck crack filler or other suitable plastic cement compound Without waiting for it to dry, apply a thick coat of roofing paint over the cement, and to reenforce this, lay on an oval pate

of unbleached muslin Smooth it out with the paintbrush while coating the cloth with paint Allow such patches twenty-four hours to dry before painting the entire roof

For the protection of guiters genuine asphaltum-base paints thickened with short fiber asbestos may be used. Small leaks can be stopped with this heavy type asphaltum paint, but where badly damaged area, are evident, these should be coated first, then reenforced with cloth patches, and immediately recoated

Where new metal roofs are to be laid, the metal should be back primed with a modern rust inhibitive metal primer before being seamed. The finished roof must be primed with the same primer before being painted the newer forms of molydenum and copper bearing galvanized sheets are, of course, especially resultant to weather and rust, but they, too, should be given a coat of galvanized in the primer and one or two coats of any of the newer and better synthetic-base roof coatings.



Although nexpensive this toy will delight any small g !

Child's Doll Bed Easily Made

## from Empty Orange Crate AN ORANGE crate can be made into a doll bed by removing the middle crosspiece and also the top deliberation as substituted for the head of the control of the head o

removing the middle crosspace and also the top sequence on each side. Then saw the head and footboards to sat your fancy and glue a spool under each corner for legs. If desired recinforcing strips of wood about '2, by %" may be fastened to the sides of the best at the top and also under the bottom.

Sandpaper the bed thoroughly spply a couple of coats of enamel and add a small decal transfer to the headboard —B P S

#### Butter-Dish Lid Covers Opened Stamp Pad

To aroun having to open his stamping nik pad frequently each day one shipping clerk uses the glass cover from a ten cent butter dish to protect the open pad from that can be protect the open pad from the cover can be lifted off and replaced in much less time than it takes to open and close the tight fitting lid of the pad.



WANTED FARM TRACTOR HINTS FOR HOME WORKSHOP SECTION If you have developed any especially good methods of repa ng and man to a ng form tractor send bref I leut afed articles descr brig them do this magazine Cosh is pad upon acceptions for all inva lable material.

#### SOLDERING PASTE

[FORMULAS]

Petrolatum plain 3 oz Zinc chloride 1 teaspoon Sal ammoniac 1 teaspoon Water 4 teaspoons

Heat the water stir in the saits until dissolved then add the pet rolatum or petroleum jelly, which is sold under various trade names and boil slightly Let cool before use Apply to well cleaned metals as a flux for solder. This is a noncorrosive flux for electrical work provided all spliced joints are taped afterwards.

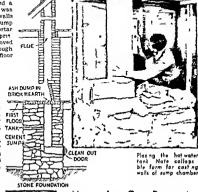
FORULAR SC ENCE MONTHLY SHOP DATA FILE

#### Hot-Water Tank Lines Fireplace Ash Dump

DISCARDED bot water tank with the ends cut off was used in constructing this improved firenisce ash dumn chute. As illustrated a collapsible wooden form was set up for casting the walls and ceiling of the sumn chamber After the mortar had set the boards compris ing the form were removed by pulling them out through the clean out door. The floor of the chamber was then cemented in flush with the door elli

Located directly over the chute the ash dump operates through an open ing in the brickwork of the hearth Where the bricks span the open top of the chute they are supported on short lengths of angle iron

The tank provides a safe fire tight lining for the shaft and the smooth metal wall permits ashes to drop freely from the hearth to the clean cut does.



#### Liquid Glue Applied with Ear Syringe

LIQUID glue may be neatly applied to any surface with a small car syringe. The mouth will become scaled of its own accord but the dry glue at the tip can be instantly removed by squeez ng moved by squeez ng



#### Keeping Glass from Sliding

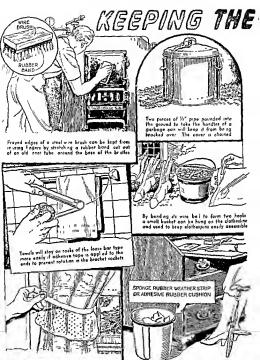


Sometimes a plate glass top si des around on a desk or table top When this happens at may be stopped by placing a piece of transparent cellulose tape folded with the sticky side out under each corner as shown in the sketch at the left

#### Measuring Cup Prevents Overfilling Lanterns

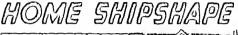
In FILLING oil lanterns the use of a measuring cup will prevent wasting kero sene by overfilling. Any can jar or bottle which holds the same amount of oil as the lantern will serve the purpose. There is then no need for pausing to watch the rising oil level—J. M.





When hanging curtains requiring to backs the window shade can be used as a guide to line up the two pas. Simply drow the shade to the proper height and push that a backs in place. This all minotes trying to sight across by eye

To prevent the upper sim of a waste basket from marring your furniture such as a desk attach a etrip of sponge rubber weather strip or adhesive subber cushion to the rim. This acts as a bumper

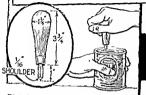




When shoe leather is scuffed lift up the loose piece apply clear cellulose cement underneath and press toward the edges with your thumb noil Scrope away excess cement



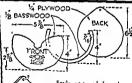
There is often room in a kitchen cabinet to install a sliding board hoving a hole into which a bowl will fit. Then one hand is free while the other shirs the contents



This tool punches holes in milk and fruit juice cans. Use a piece of slim taper file and gried point to a pyramid shape, making all edges been



A window washer can keep his drying towel at hand by knotting one corner and inserting the knot in his hip packet. If will not foll aut





Easily jig sowed from bosswood and plywood, this holder provides a convenient place for staring the rubber sink stopper when it is not being used Fasten halder obove the sink in a handy lacotion



Quilt blacks to be cut from silk scraps can be prevented from slipping if each piece is gripped with fine sandpaper cut to form a double pattern

#### Two-Handled Wire Brush Scours Scaly Paint

AS AN AID in using a wire brush with both hands for scouring paint from buildings, boil the short leaf from an old suto spring onto the brush or use a suitable piece of strap iron Drus screws into the wood at each side of the handle as shown below to keep it from turning



#### Butt Hinge Helps Bend Sheet-Metal Edges

WITHOUT special tools it is deficult to bend up the edges of sheat metal nearly Perfect work can be done however, by using a large but hinge and a pair of ship joint pilers as illustrated in the photograph below. The lunge makes possible the hending of sharp corners and prevents marring the piece of metal.



# 6

#### Disk in Haop Backs Cloth

A WOODEY disk, turned to fit inside an emprondery hoop is useful to back stretched cloth when designs have to be transferred to it by the hot from method or traced by hand Strips of tape also can easily be held with this device for marking, as shown above A fairly hard wood is the best kind for this purpose.

#### Cardboard Box Converted into Temporary File

For temporary use a correspondence file can be made from an ordurary two-section cardboard box Remove an end from both sections and hold them to-



gether with a couple of rubber bands as iltustrated. The file can easily be extended for removing and filing individual letters



#### Suction-Cup Door Bumper

TO ATTACH a door bumper for temporary use without marring the woodwork, improvise one as shown above. A rubber suction coup is attached to a small cork by means of the screw, and the cork is forced into a rubber crutch tip. The suction cup will hold the bumper on any smooth surface.



NIGHT performances the Willough by, Ohlo High School band arouses much favorable comment by the special rules of illuminated batons and universal Stadium or auditorium lights are tigned out and the band uniform lamps and luminated batons instantly turned on The light display with the missic provides an impressive spectacle. Illimature electric times and batteries of the fash-light type and the stade of the special rules are the control of the stade of the special rules are the created without the created without provides and the created without the created wit

The construction of an illuminated balon similar to that at led by the bind is shown to not be ended of a length of nickel lawe for chrome plated pipe measuring about \( \frac{\pi}{n} \) in outside dumeter are mounted metal-based two cell flash lights these use the 1° diameter balon' type battery cell

Several small holes are cut in the front ring and reflector of each flash light to let rays from the lamp pass out through the sides Colored gel atm or cellulose film disks are placed behind the lens which preferably, should be of the bullese's variety so that it will be visible from the side Set screws prevent the cases from unscrewing out of the caps as the baton is whirled The tailing of the baton presents a beautiful pattern in the dark

The Willoughby band also uses colored electric lamps installed on the shoulders, chest and caps of the players uniforms. Flash-light lamps colored filters for them, small flexible wires, and the necessary battery cells are the out; equipment required.

The method of illuminating a bandsman's cap is shown in detail. The lamp is turned on or off by screwing it in or out, and it should therefore fit the socket tightly enough to prevent its loss when partiv

to prevent its loss whe

Uniform lights are similarly arranged, but should include a switch. A flash light minus its less in carried in a pocket. It is fitted with a plug which can be screwed into the lamp socket and wires run from this ket and wires run from this plug to lamps mounted on shoulders and chest or other parts of the uniform So-called Like wire? is excellent because

it is small and highly flexible.
This wire was formerly much used for installing loop radio aerials—WALTER E. BURTON



Method of mounting lamp in a bandsman's cap The bulb must fit the socket tightly



#### Small Trouble Lomp for Confined Work

With splieng wires in confined spaces the average trouble magnetic secessive light and heat A small night light builb with guard and awitch attached is better for most work of this kind. A soft rub her plug and a weatherproof socket are used. The connections where are used the connections where the seatherproof socket and enters are plug should be protected with rubber tape and this in turn covered with rubber hose—RAY BLAIN

#### Eaves-Trough Fixture Holds New Tubular Lamps

EXCELLANT reflectors for tubular fluorescent imps can be made from ordinary galvanized iron caves trough. The photographs show a glything unit for two 24 long 20 with lamps Two 20 lengths of 5 trough were soldered to were soldered in place. A suffering strip were soldered in place A suffering strip also acts as a base for the resctance units.

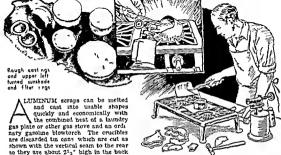
Rectangular holes were cut for the lamp sockets and the reactance units were fastened to the stiffen ng etr p with self tapping screws. The nauds surface of the troughs were given a coat of alumnium paint followed by two coats of white casein paint. On the outside the reflector unit was finished with lacquer.

A length of 3 stoveppe was separated at the seam spread apart and provided with soil dered on ends so as to form a cover for the reactances and wiring. It ships down around the projecting parts of the sockets. The cover was then finished with crystal lacquer—EATY WAITES.



## PARENEW SHOP IDEAS

# Melt Aluminum Scraps



Pour ng the alum num from the fin can crucible into a tin can mold Above how the heat is applied

shown with the vertical seam to the rear so they are about 21<sub>2</sub> 's ligh in the back and from 3" to 4" high in front The can is set over the burning gas jet on an an gle so the high side faces to the front The lighted blowforch is set against the gas plate frame and in the majority of car's will say there without being held The flame of the torch is directed to the in-

The fiame of the torch is directed to the inside of the tim can and aimed at one side so that it will swirl over the aluminum Small bits of sliminium scraps are added, and the heat melts them very quickly Round aluminum stock for turning may be cast in discarded tims in various shapes

and forms It is advisable to direct the

flame of the torch on these tins a short time prior to pouring the molten metal Oxidation will occur unless the molten metal is stirred constantly but it does no great harm as pure metal will pour from the bottom of crucible leaving the oxidized metal in the crucible One necessary warn ing is to use only pure alumnum in the

ties as various other similar metals cause

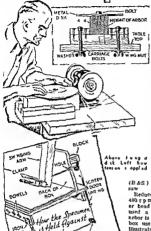
the tin itself to melt. A cast iron crucible can be used successfully if available, but will take longer to heat

Castings used in turning parts for small motors camera fittings and the like have been made by this method up to 4" diameter and 4" high and plates up to 1" thick and 5" square—Charles H Gottwalt

#### Bronze-Welding Broken Gears

Wist a broken gear tooth has to be built up by bronze welding chip off what is left of the tooth and undercut the gear rim about 1% If two or more adjacent teeth are Involved follow the same rule but also remove one third of both connecting sound teeth so as to strengthen the patch and ease the milling operation—H J C

## Mineral Specimen Saw



#### BY W I BAXIER

Woodrow W son H th School Washington D C

OCKS and mineral specimens can be sectioned on this easily built saw into islabs of any desired thick ness for exhib tion scentific pur poses or for grinding into semi precio is gem stone cabochous. The saw can e ther be a dia.

man charged six (PS M April 20 00) Duming in kerosene and horrosting oil or a plan steel disk running in a mixture of sill con carb de grit. No 100 mesh and water to which a 1tie fine clay four has been added It sil con carb de grit is used be sure all bearings are protected A disk 10 or 12" in diameter

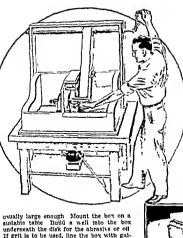
e ag d
it how
oppled
oppled
may be used for the gnt saw but
a hard steel disk of 20 or 22 gauge
(B &S ) is required for making the diamond

Reduce the speed of the arbor to around 400 rp m Where a bench type buffer grind er head or a so called saw mandrel is used a countershaft will do this If the arbor is mounted directly on the side of the box use a large pulley Both methods are flustrated

Any size box can be used but one from 4" to 36" in length and about 24" wide is



174 NEW SHOP IDEAS



SPECIMEN

SMALL

HAND KAREW

Clamp

CARRIAGE

BOOLT

BLOCK

SPECIMEN

HARDWOOD

A.2 2-6

4-4-ARM

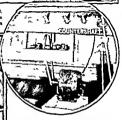
THIS SPINDLE

Alternate Method of Holding Specimen

usually large enough Mount the box on a suntable table Duild a well into the box underneath the disk for the abrasite or oil I grit is to be used, line the box with galvanized iron or preferably eopper Tin is a suitable lining for the diamond saw because oil is used Shield the top of the box directly over the disk to avoid spiashing A light built into the box to filuminate the saw is handy

In making the pipe assembly for the top have the large pipe welded onto the small pipe. The weld should be ground down below the jevel

of the large pipe. The righthand end of the large pipe ht sight above cut groove in specimen before applying tension



Above countershaft mounted under table Left machine with arbor on side of box must of course he threaded to fit the flanges. Tension is applied to the arm to bold the specimens against the blade by means of a screen door spring small rope and pulleys. Hold the specimen against the blade until a shallow groove is formed before applying tension. Not the woofen rathest for bold ing the arm forward while clamping or traversing the specimen.

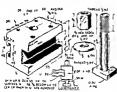
When the saw is in operation a cloth is hung in front to prevent splashing. Two hooks for this purpose ere soldered on the front of the shade over the lamp. They can be seen in the photo which shows the first step in starting to cut a specimen. The saw cuts from the top toward the bottom of the specimen.

The saying dak must be true A quick method of testing a bumpy disk is shown at the beginning of the article. The saw pivols on a boil telepole through the arbor hole into a hole in a 4 by 4" skiding block and the block is pushed forward until the blade foundes an abrassive wheel If the sliding block wears or fist too loosely sook it in water a few minutes before using A wet they will be the same and the same the same they will prevent burning.

#### Slotted Lathe Tool Post Stays in Adjustment

ONE advantage of the lathe tool post II instrated is that it holds the cutter buts at the proper height and when the position of the tool is changed the height does not have to be readjusted. In addition it chini hates the necessity for tool but holders. To slot the tool holder drill a %" hole

To slot the tool holder drill a 1/2" hole through it as shown and clamp it to the compound rest with the holding stud. An end mill se placed in the headstock and the block is shimmed up so that the bottom of



The large slot in the halder a used for var ous term ing tools and the other slot for a partieg tool

#### Hose Prevents Breaking New Gauge Glass

Wiley the glass tube of a water or steam gauge is being replaced it pays to protect it with a six length of rubber hose This is pushed to the end where the wrench is being applied and prevents breakage in case the wrench slips

The cutting edge of a carbide tipped tool should never be as thin as if the tool were made of high speed steel —H J C

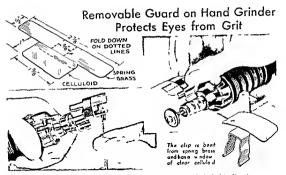


the miling cutter will cut a slot that will be \*s\* below the center line of the lethe when the block is later clamped directly to the compound rest without shims

The slot on the other side for holding a parting tool is cut in 7/32" deep with a 7/16" end mill its height depends upon the lathe on which the holder is to be used Next lusert a 3s "key seat cutter and mill this slot as ahown

The tool bits ere held with hollow head safety set screws. The regular tool post wedge is used to adjust the helght of the





Made for use with abrasive wheels on high speed hand grinders this little guard will protect the eyes from flying particles. It is cut from thin spring brass to the shape shown and the clips are bent to grip the chuck sleeve firmly Approximate dimen sions are given but slight alterations may be necessary to adapt the guard to other style grinders. A piece of clear celluloid or cleaned photo film stock to cemented to the metal extension. When the cement has set, the metal is bent—H H

#### Battery Clips Serve as Clamps

EXCELLENT clamps for giung model parts or other small work can be made from battery clips of the type abown These have strong jaws and will hold firmly any work within their capacity. To protect the surface provide each clip with a pair of wood blocks slotted to fit over the edges of the jaws.



#### FORGE WELDING, PART 1

I METAL WORKING I

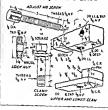
- 1 A clean fire, free of ash and dirt, is required It should be built from a good grade of soft coal well coked that is with all the oils heated out of it. The fire must be packed down, and all coke broken into small pieces.
- 2 Both pieces of metal must be evenly heated and both brought to a welding heat at exactly the same time. Welding heat is determined by watching the flame over the fire for 'steel stars' seen coming from the pieces being welded.
- 3 As soon as welding heat is reached the pieces must be handled quickly before the metal has chance to cool. Be sure that both pieces are sparking On way to anvil, tap both pieces gently to jar off any dirt sticking to them.
- 4 Overlap pieces on the anvil in the position in which they are to be welded and tap gently at first with the hammer. As the pieces cool, increase the hammer pressure

POPULAR SCIENCE MONTHLY SHOP DATA FILE



#### Simple Adjustable Stop for a Lathe Carriage

THIS adjustable lathe carriage stop which clamps on the outer V way of the lathe as shown is a useful accessory. The upper half is cut from a piece of \$\frac{1}{2}\$, by \$\frac{1}{2}\$, "by \$2.5/16 stock from a piece of \$\frac{1}{2}\$, by \$\frac{1}{2}\$, "by \$2.5/16 stock from a piece of \$\frac{1}{2}\$, some size a cold router of \$\frac{1}{2}\$, some atom is rivered a piece of \$\frac{1}{2}\$, some atom from \$\frac{1}{2}\$," and followed stock the adjusting screw from \$\frac{1}{2}\$," atom of the lock nut from 1" stock and the lock nut from 1" stock and the lock nut from 1" stock the adjusting screw \$\frac{1}{2}\$ BLOON



#### Scale an Drawing Board Is Aid in Drafting

IN CEPTAIN types of drafting where many horizontal lines have to he ruled it saves time to attach a transparent cellulod rule to the board with short countersusk wood screws. The left hand edge of the board is first sanded to a depth corresponding to that of the scale used A second rule may be placed along the top edge of the drafting board if desarries.

As a temporary expedient a dressmaker s cloth measuring tape may be held in place with thumb tacks Do not however try to use the cloth tape continually for it will soon wear out --E T ORCHARD



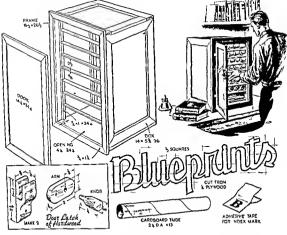
#### Restoring Burred Threads

O's method of restoring a burred thread on the end of a shaft or holt is to use an extra nut of the same pitch. Saw this in half and clamp the halves on the thread back of the portion that has been damaged. Apply a heavy oil then screw the half nuts wont towards the end—C. H.

#### Pipe Cleaner Pinned to Board Serves as a Pen Wiper

FOR cleaning either rubing pers or ordinary steel pers a pipe cleaner is much more convenient than a cloth. The cleaner can be fastlened to the corner of a drawing board with a building in as shown at the right. One movement will be drawing pur removes all the ink. The cleaner is easily removed and an other substituted when it states to become drity from use—O I





#### Blueprint Cabinet Built from a Packing Case

EVER1 shop requires a place to keep the blueprint drsw. ws and flat plan sheets that are bound to accumulate A neat roomly cabinet for this purpose may be made from an ordinary plywood packing case Measuring from one end mark off a section 15½" wide 14" deep and 26" high said out this out These from the material left over cut a fourth side and mail to also the whole forms a small box.

Two ladderlike sets of spacers 1" wide are next prepared the sidepieces being 3," thick and the crosspices or abelies 3.7 These are inserted near the front and the back of the box as shown A door frame of 3.7 by 11.7 stock is also made and nailed on the front of the box and a door is con structed to fit A wooden latch for locking the cabinet can be added

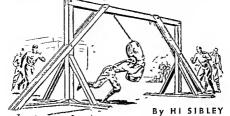
The cardboard tubes for holding the blue prints are 21," in diameter and 13" long with adhesive tape labels. The index is let tered or typewritten on paper and tacked inside the door—CHARLES JEGLYSKI

#### Cement and Linseed Oil . Seal Pipe Jaints

Ove plumbing firm saves money by seal ing water and steam pipe joints with a mix ture of Portland cement and boiled inseed oil. This has been found as satisfactory as the usual lead mixture. There is always much unavoidable waste of any pipe cement but with the cheaper mixture this is no longer of much consequence—RO L



## Tackling Dummies

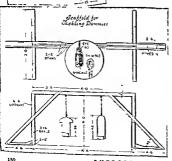


OUGH materials and heavy reenforcement are essential in making tackling dummies for a football squad Athletic coaches usually bave favorite designa to suit their own special training technique, but the accompanying illustrations abow two types adaptable to all around use

Each dummy is made of beavy canvas with a leather boot on the bottom The ring for suspension is secured with leather straps double

stitched as indicated. The bottom is filled with sand to the required weight, and the upper part is stuffed with kapok or similar upholstery material that will not pack One coach suspends

two dummies from a scaffold as shown in the drawings, one of them with about balf as much sand weight as the oth er The rope should be hung over a thimble un fess a spring or pulley suspension is preferred. The scaffold timbers are of the dimensions given, assembled with 12" carriage bolts This particular design is very sturdy, and bas been in use by the champlon Pasadena (Calif ) Junior College



## AND OTHER FOOTBALL TRAINING EQUIPMENT



team for several seasons with great success
The same team uses the bucking machine

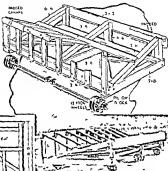
The same team uses the outling machine shown in other illustrations. It is built of heavy timbers assembled with 12" carriage boils and mounted on six pairs of iron cultivator wheels. The axies turn with the wheels and are mounted in stock pillow blocks (plain bearings), which can be ob-

tained from a hardware dealer or mail order house. The conners of all exposed timbers should be rounded to prevent injury from splinters. The uprights are padded as are the long borizontal members on each side. A slate gray is the most suitable color for painting the framework.

Naturally, such a huge device is not intended to be pushed easily With its great weight, only two or three men are required on the defensive side to give the seven forwards a thorney that the property of the seven forwards a thorney or the seven forwards as the seven forwards as

ough workout The machine should be used only on hard, dry ground because the wheels would bog down in the mud in wet weather

This equipment is used by a team averaging about 180 ib For lighter grammar or private school teams smaller timbers may be used such as 4" by 4" or 5 by 5 instead of 6 by 6"







This heavy bucking frame is big enough for seven men at a time, with two or three on the other side for opposition



#### Cheese Bait Is Improved by Cooking with Motch



FISHEMEN Who use commercial fish bait of the type made from cheese often find that it dissolves quickly in the water or becomes dislodged from the hooks because of its crum bly nature. To prevent this one fish erman says that it is necessary ooly

to mold the bait on the gang hook in the usual manner then hold it in the flame of a lighted match to sear the cheese around

the outs de

This cooking he claims gives the bait a
rubbery consisteocy so it ataya firmly on
the hook and also seems to make it more
attractive to the fish.



#### Handle Under Bushel Basket Helps in Emptying It

FARMERS and gardeners will find that a leather or rubber strap if atlached to the bottom of a bushel basket will aid in emp tying the contents into bins or barrels. The strap should be twisted once before the ends are riveted in place as this makes it easier to linert the fingers.

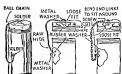


## Angleworm Bait Carried in Old Starm Rubber

A discarded atom rubber being noise less and free from sharp edges serves much better than a thi can to carry angleworn bat in a boat. It is placed flat upon the boat seat for selecting the worms but at other times it hangs from a nail or hook where it is out of the way—G. H.

#### Easy Woys ta Fasten Cop to Fishing-Rod Case

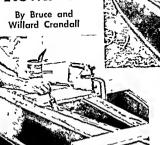
THE caps of alumnum fishing rod cases are all too easily lost or dropped overboard. This can be prevented by the ample expedient of fastening the cap to the case by one of the three methods illustrated below. Note the swivel arrangement required for rawbide or link chain ball chain does not require this Use soft rubber washers as shown to moure water tightness at the connections—R. C. R.



Replanking [

A FLAT-BOTTOMED

Rowhoat



Plane the surfaces of the chines and side plants perfectly smooth Left use cotton wicking sooth with marine glue or white lead to make all the seams water tight

O SPECIAL skill or knowledge of boat building in required to replace the bottom of an ordinary fiat-bottomed rowboat, provided the sides and other parts of the boat are in good enough condition to make the job worth while. In most cases the materials will cost less than five dollars

In the boat shown the chines as well as

the entire bottom outside keel and skee had been destroyed by marine borers so it was essential to put new chine pieces on the outside of the boat. Ordinarily this would not be necessary

Excessive swelling of the planks is one thing to guard against because it causes bucking and leaks at the chine. This is likely to result from the use of material that has been too well seasoned or kind dried. If usually can be minimized by using narrow planks, 4" or less, and by not forcing them tightly together. White cedar and cypriess are generally the most satisfactory woods, although other woods such as red cedar, spruce, fir, redwood, and yellow or white spruce, fir, redwood, and yellow or white

pine often give very good results.

After the old planking has been removed the edges of the side planks and chines should be planed smooth. Keep them flat so that the planking will fit perfectly It is usually best to start laying the planks in the middle, but check first to see bow well they come

out at the bow and stern

Before the planks are put in place, a couple of strands of cotton wicking should be laid along the edge of the chines and transom. The wicking and the edge of the side plank chine, and transom should be coated with marine glue, soft white lead, or thick paint. Lay a similar strip of cotton wicking on the edge of each bottom plank before the next plank is quit in place.

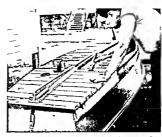
The bottom planking should be fastened to the chunes and side planks with brass or galvanized screws or galvanized naise, spaced about 1½- apart. The planks should be sawed off flush with the sides as the work proceeds. Do not clamp or force each plank too tightly against the next one, but feave the seam open at least the thickness of a back-saw blade. You may, if you wish, determine by experiment ahead of time how much a plank of the particular jumber you are using is hiely to swell and make the seams accordingly. Another way of making the bottom seams

another way or making the bottom sea

water tight is to calk them after the planks are in place In this case the edges of the bottom planking should be beveled slightly to make a calking seam which is closed on the inside but left open about 1 16 on the outside to receive the calking later If the hottom planks fit

perfectly it is often not nec essary to have any kind of calking or anything whatso ever between the seams of a Planking flat bottom boat less than 5," should not be selected unless some special type of construction such as is followed. batten seam Never use ordinary tongue and groove material If extra ight weight is desired the bottom can be covered with a single piece of marine ply wood 3, " or 1, thick matead

of planking Cut it with a fine toothed saw After the bottom is in place the edges should be planed smooth and flush with the aide planking and the outside keel and skeg



With anly a few tools anyone can install a new bottom on a flat bottom rowboat Narrow plant ng prevents swell ng and buckling

added as desired Copper paint should be used if the boat is to be left in salt water otherwise regular marine paint will prove satisfactory



#### Rubber Shack Absorbers for Hedge Clippers

HEDGE TRIMMING shears of the type shown will not cause an annoying shock or far to your arms if you cut two abort lengths from an old garden hose alit them open along one side and fit them over the ferrules Fasten them permanently with tacks driven into the wood of the handles -G E H

#### Boll Aids in Throwing Rope over House Roof

WHEN it is necessary to carry a rope over the top of a house to pull up ladders and rigging or for other purposes attach one end of a fishline or kite string to a soft sponge rubber ball and the other end to the rope Then throw the ball over the roof and pull up the rope. The advantage of using a rubber hall is that it is not likely to break & window pane if it goes askew when thrown awkwardly -- CARL L. SAN YER

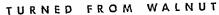
#### Bigger Flukes Improve Light Rowboot Anchor

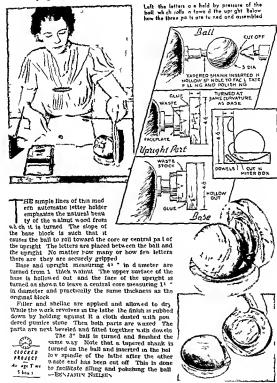
TO INCREASE the & GALVANIZED holding power of a light rowboat kedge anchor seen out two triangular shaped pieces of galvanized iron about 3, " thick and about three times the area of the pres ent flukes Then riv et them flat onto the flukes. If desired coat the anchor with alummum paint.



increase the hold na aualty of the anchor

# Novel Automatic Letter Holder





# Eame-Cia E Plagues

#### IT'S EASY TO CARVE THEM IF YOU FOLLOW THE RIGHT METHOD

NY amateur craftsman with a reason ably good eye for proport on and color can carve and color lifelike min ature game bird plaques

The male and female mallards illustrated are made from 2 white pure The gram should run along the wings if possible. They are carred in what may be called high releft giving the impression of depth and round ness. When the wings are well shaped the feathers may he indeated by carving tools or an electric burning needle. The needle also below in shaping the bil mostrins and

Color plates to copy may be found in any brary and somet mes helpful painting appear on magazine covers. Plat o I colors are best except for the head of the main. The pecul ar irdescent green sheen of the head may be produced by applying green bronze powder over wet shellar.

owder over wet shellad The female is painted a light warm brown

on upper head neck, wings and body fading to a very light buff on the breast and under body The markings on the head and neck are in the form of brown dots worked into the V shaped markings of the ends of the back feathers The wing tips and the wing coverlets are dark brown fading into the warm brown The color hand on the trailing edge of the wing Is blue violet with white hara on each a de of it The bill is a yellow brown darker on the end.

The coloring of the male is familiar to every



Abo s ide and fast vers of duck had to a d n corvey 1 RgH bour that had to ad n corvey of the state of the st

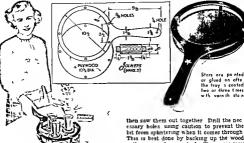


When carefully carved and painted the model presents a real stic appearance and will enhance any den Other birds and fish can be adapted to this type of craftwork

posite page A screw eye is added for hang-Pheasant quail and game fish would also be adaptable for this sort of craftwork and may be made in the same way

îne

#### Plywood Serving Tray Is Shaped Like Banjo



ESIGNED in banjo shape this unique plywood serving tray suggests something of the picturesque charm of the Old South It would make a distinctive gift and since the construction is simple two or more of the trays could be made up at one time very quickly

With a compaes and some freehand aketching lay out the frame and bottom

essary holes using caution to prevent the bit from splintering when it comes through This is best done by backing up the wood with a piece of acrap stock. The pieces may then be separated and the maide cut made

Turn all the joiners at once cut them off and clamp and glue securely Follow with a thorough sanding and any type of finish desired. One method is to apply three coats of walnut varnish stain and rub down

the last after it has dried for several days. Stars may be either glued on or painted-BRUCE MACINTOSH

PROJECT Average T me

#### Chapping Bawl Cut Down for Serving Salads

AN INEXPENSIVE chopping bowl can be transformed into an attractive salad bowl by cutting it on a fig saw to the shape shown The edges are rounded off and the whole bowl sanded to smoothness. It is then mounted on three feet 1" in diameter turned from maple. The tops of the knobs are sanded flat to fit the undersurface of the bowl A light varnish stain is applied for a natural golden finish -B B BRONSON







#### Print of a Child's Hand Preserved in Plaster

A PRINT of a child's hand can easily be preserved in the form of a plaster plaque. Obtain a 6" wooden embrondery hopy and cut the inner hoop at one place so it will spring out when the outer hoop is withdrawn from it. Lay a board on a level sold surface and place a sheet of while paper over it. Fit the cut hoop inside the outer one and lay them flat on the paper over one and lay them flat on the paper.

Mrx plaster of Paris with water to a thick creamy consistency and pour it in side the ring. When the mixture begins to harden place the child's hand in the mold fingers extended and spaced evenly Press the fingers firmly one at a time and also press the hand itself into the plaster. Hold the hand down for several minutes until the

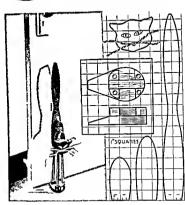
plaster is no longer sticky After the hand has been withdrawn let the plaster set for half an hour Re move the outer hoop spring the in ner hoop away from the plaque and trim the paper to the size of the plaque Then let the plaster dry thoroughly

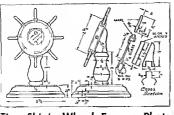
A pastel shade paint will give depth to the hand print. For hang ing glue a loop of ribbon securely on the back—B P SMITH

# Comical Wooden Cat Does Duty as a Doorstop

NOVELTY sales appeal and economical production by amateur craftsmen were the considerations that prompted the design of this amusing black cat door stop It is another project developed at the New York workshop of the Metropola tan Junior Achievement.

The doorstop may be readily put together from odd scraps of wood Body bead tail and base are sawn from % stock The legs are common 1-7 dow els For the whiskers pipe cleaners are used and the eyes may be painted directly on the wood or cut from white adhesive tags and marked with ink—K.







## Tiny Ship's Wheel Frames Photo



ANYONE who enjoys wood turning will find this small picture hidder an interesting project to make from scrape of walout. All though intended as a frame for a snapshot, it can be adapted to hold a watch circular ther momenter or any other small round instrument. If a watch is to be as! in the steering wheel may have to be a luttle thicker but this depends upon the thickness of the watch.

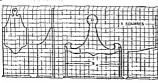
The turning is all straightaway work and it will be found easy enough to drill the rim for the pegs if time is taken to make an angle support for the wheel as shown at left

The parts can be given a high gloss in the lathe with French polish (shel lac and a hittle oil) applied on a piece of cloth if a less glossy finish is de sired rub it down afterwards with furmiture wax.—Michael Kolisko

elockis PROJICT Annage T me SVe bon s

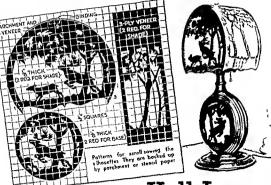
#### Hanging Racks Copied from Pipe Boxes

THE designs for the two boxes drawn below are adaptations of Early American pipe boxes. The large box pletured in its finished form at the right is useful in the half for glotes and scarts while the smaller box can hold let test to be taken to the post office elothes brushes or any thing of that sort. The boxes are made of ½ knotty white pine—HENRY R. DIMOND





Scarts gloves and 1 m lar or t cles can be kept in the box above f hung n the hall At left drawings for the boxes





# Hall Lamp DECORATED

## WITH JIG-SAWED PANFLS

to allow for the wiring and mortise it for the toggle switch Turn and finish the ring completely before cutting out the inside. which needs only one coat

of shellac or varnish to protect it from moisture Cut the rabbets to take the fretwork just deep enough to hold the 1/4" wood plus the thickness of the parchment you intend to use as a backing for the silhouettes

To assemble the turned parts when finished, file a flat place on the ring long enough to contact the flat part of the base Drill a 3," hole in the center and assemble by using a 14" nipple 21," long with a 14 nut at each end To add the spindle, flatten the center bead of the ring and bore a 13," hole just deep enough to set the

ESIGNED for use in an entrance haliway, this decorative table lamp bas a night light built into its lower section The wooden parts are walnut, although I have duplicated the lamp in both maple and mabogany with

The turned parts consist of the base, which is 6" in diameter and made from 2" stock the ring 61," in diameter and also made from 2" stock, and the spindle, which is turned from a 2 by 2" by 3" block Cup out the underside of the base deep enough

spindle flush on the ring or as an alterna tive cut a shoulder instead of a bead at the base of the spindle and carve the shoulder to fit over the heads on the ring Drill a 3," hole through spindle and ring Attach a standard pull chain socket to a 414" mip ple thread through the spindle and ring and lock with a 1/3" gut On the inside of the ring screw a candelabra socket

In wiring the lamp break one of the leads at the toggle switch then continue the two leads to the porcelain socket and thence to the pull chain socket. The toggle switch controls both lamps but the pull chain con trols only the upper lamp Use a 7 watt candelabra lamp for the night hight and a 40 watt lamp under the shade

For the bent section of the shade glue three layers of walnut veneer—sufficient for two panels 31, by 95," The flat mg sawed panels on both the shade and the base are thick walnut 8" in diameter for the shade and 5" for the base Cut the des gas m all with a 30 or 40 tooth blade to get a fair ly smooth edge Glue parchment or stencil paper to the base alhouettes and to the flat panels of the shade but not to the weneer panels The base panels are held in the ring rabbets with %" No 0 brass screws In assembling the shade fasten three

stretchers 14" by 24" by 3" to the flat panels where indicated by the dotted lines. and sand the projecting corners until the stretchers are flush with the curve Spread give on the edges and on the underside of the ng sawed veneer panels. Take a strip of parchment about 4" by 20", fold the end under the first stretcher and tack tempo rardy then pull it tight around the circumference of the shade and fasten to the third stretcher Center the two vencer panels on stretcher No 2 and nail in place Bend the veneer down and clamp the ends to stretchers Nos 1 and 3 Nail the veneer to the edge at 3," intervals with %" No 20 brads Drill holes in the walnut if it is brittle. Nail the veneer to the stretchers

Cut off the overhaps of veneer and parchment and round the edges slightly with sandnaper Cover the joint at the top with a piece 1,5" by 5,4" by 31,4" Finish the wood to match the turned parts Attach a spring chp at the center of the top to hold the lamp shade - EDW ARD J HOBERT

## Pewter Accessories Dress Up Ten-Cent Tumblers



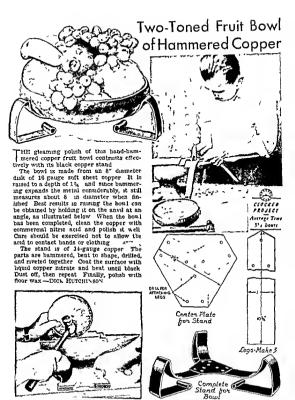
be made by adding decorative pewter tops to blue tumblers from the five-

Eighteen gauge pewter is cut into disks 1/16" larger than the top of the glasses A strip 1," wide is then shaped to fit Inside and soldered to the disk Take

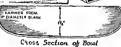
CLOCKED PROJECT Average Time 64 bou s

care not to melt the pewter Smooth the joint with emery cloth and polish all with 09 steel wool Use blue beads for the knobs Cut pewter as shown and shape to fit around the bead The top final is made by melting a bit of pewter and thrust ing a short length of 16 gauge copper wire into it The wire is then threaded through the bead and the pewter Bent down and soldered to the underside of the lid it holds the knob firmly The realistic strawberry knob on the larger jam dish is a dress but ton also fastened by a copper wire threaded

through its eye and soldered under the lid The plate is made from a 5" pewter disk and shaped on wooden forming molds with a rawhide mallet .- M. S. Horkins



The bowl is shaped by holding it at an angle on the anvil and hammering in concentric circles

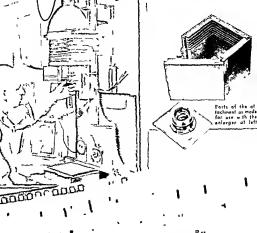


CRAFTWORK

These are riveted as in the upper photo then coated with liquid copper nitrate and heated to blacken the metal

The stand consists of three

legs and a connecting piece



ALFRED P. LANE

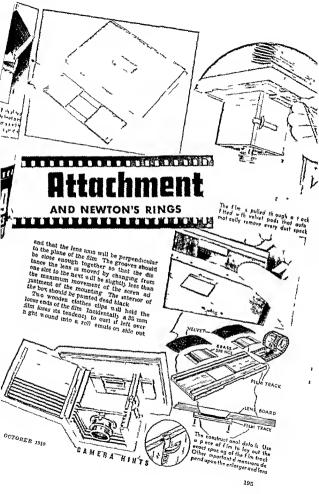
UST and Newton s rings cause more greet to the minature camera en thusant who does his own enlarging than all other difficulties put to gether Particles of dust seem to take a feendash delpht in getting on the negative yet the more pains you take to get the jegative and the contacting glass surfaces spot lessly clean the greater the chance of trouble with colored rings caused by light interest which we have the colored rings caused by light interest and the colored rings the form of mysic rings the processing the colored rings that the form of mysic seems to the colored rings that the form of mysic seems the seems of the colored rings that the form of mysic seems the seems of the seems

Both troubles can be avoided by using a miniature enlarging unit like the one shown. This was designed to work with any stand and size enlarger, but the same method of handling film can be applied to many types of strictly miniature enlargers

The parts consist of a duplicate of the lens board of the enlarger a film track which is screwed to it and a lens housing that holds the lens and provides a means of coarse adjustment for the focusing

The film track requires two strips of wood (sawed m one long piece of course and then cut apart) with the face side sawed as shown to provide a groove or rabbet for the edge of the film. The tracks are screwed to two rectangular pieces Velvet is cemented to these pieces at both ends and smaller rectangular pieces of thin brass shim stock are located under the uncemented center portion of each pad. The bruss pieces should have just enough spring to push the velvet against the emulsion surface with a very gentle pressure. In use these velvet pads re move every speck of dust as the film is pushed through and the absence of glass prevents any trouble with Newton's rings

The sides and door of the lens box are cut from a long board after the grooves have been dadoed or sawn into it. This insures that the slots will match at the corners



#### Rubber Band Guards Edge of Visual Filter

If you carry a visual filter of the colored or monotone type for any length of time the edge is likely to become ch pped from knocking against hard objects. As a pre ventive sl p a fairly w de short rubber band around the filter and cement at in place with shellac or rubber cement - C L



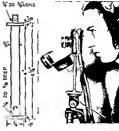
The edge is kept from this point by a rubber band

#### Lens Aids in Reading Meter in Dim Light

WHEN you use a photo electric exposure meter to judge dim light the pointer rests in a crowded reg on of the scale where it is difficult to take an accurate reading. That dial can be read much more easily by ob ta ning a small plane convex lens from an old camera view finder or other optical in strument and attaching it directly to the dial cover glass with cellulose cement or Canada balsam. The lens should not be so thick that it projects beyond the outside sur face of the meter case -- EDW ARP BURNHAM



small discarded lens is comented to the cover glass of the d al to magn fy the crowded dys ons



#### Tripad Extension Lets Camera Stay in Case

OUTDOORS it is preferable to keep a min iature camera protected by the case even when a tripod is used. This is usually pravented however by the short distance from the fult top to the tripod head as a result of which the leather flap cannot drop low enough to clear the lens

The simplest remedy is to make a tripod extension as shown from a pieca of 4," round brass rod 4" or 5" long Turn down one end to 1, or to suit the depth of the tripod socket in the case. Thread this end 14 20 to match the socket threads The oth er end is drilled to a depth depending upon the length of the tilt top thread then tapped 1, " 20 If desired flanges may be turned as shown so that the diameter of the extension is reduced to a. -NATHAN SPERSER

#### Haw to Remove **Bubbles** in Tank

More than ordinary ago tation is often required to distodge small air bubbles from a roll film after the tank is first filled with developer The bubbles are best jarred free by insert ing a mckeled but tonkook into the tank and lifting the reel up and down sharply three or four times as necessary -OLIVERBANDFLIER





Sunk flu h with the top of the wo stable or shelf the heate consists of two cose tins inclosing o 20 watt bulb. Upper left, the supporting brocket

#### RETOUCHING PRINTS, PART 2 [PHOTOGRAPHY]

madvertently no photograph c paper will

be damaged -E B W

Water Color Small cards coated with black white and sepia are available at photo supply shops and offer a convenient source of water colors for spotting prust Use a spotting brush and dot the color on do not attempt to paint the area For work on glossy or ferrotyped prints add a little mucilage to the water and experiment until the gloss of the color when dry matches that of the print

Dry Spotting Special carbon and photo positive retouching pencils are quite satisfactory and may be obtained in several shades. Ordinary lead pencils leave too much sheen on most emulsions but they may be used on some if the spotting is carefully rubbed in with the finger tip

Gloss / Prints These are difficult to work on without leaving evidence of the retouching Some workers claim however that coating the sur face with negative retouching medium spotting with a pencil then re soaking and ferrotyping will give excellent results

POPULAR SC ENCE MONTHLY SHOP DATA FILE

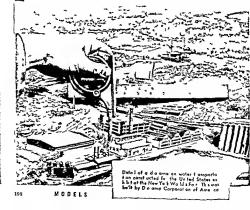


s des top and bottom that slant a

## SCENES

F YOU were able to visit the New York World's Fair you must have been impressed by the lavish use throughout the entire exhibition of large and small dioramas or miniature scenes In almost every build ng these have been used to portray outstanding events methods of manufacture his toric places and all kinds of informa tion in vivid colorful three dimens onal form

Whether it was an old fashioned stagecoach stopping before an inn a modern Coast Guard vessel on patrol a blast furnace in operation a series of bistorical views like the Forward March of America or something as huge as the City of Light and Rail roads in Action these scenes were startling in their reality. They were illuminated by hidden lights and some even showed the same scene under various I ghting effects such as dawn



# IN MIMIATURE

to dawn—all so beautifully done that you felt you were looking at a Lilhputian world

These dioramas imitate life far better than any picture because there is depth to Their nat them ural power to at tract attention has made them ex tremely popular for window dis plays and advertis ing and as per manent exhibits in museums schools and libraries

As you looked at them, you may have wondered whether you could build similar models on a small scale as ornaments or for advertising or educational purposes You can By using the methods shown in the accompanying il lustrations you will find it com paratively easy to doplicate scenes like those just mentioned or oth ers of your own choosing Bear in mind however that the sketches and measurements are examples chosen to show the general principles of the art and are not in tended to be copied in their entirety for

any one diorama Details vary in each case. You will notice that there are two kinds of dioramas one with a square or flat background and the other with a curved background. The latter is used when the effect of distance or a far borrous is re-

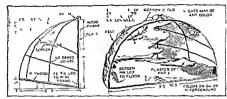
CONTINUE DETAL BY PAINTING CARDSDARD OVER GLASS FOR FRONT OF DIORAMA RAISES

Hints on constructing small dioramas for home decorations, window displays, and advertising or educational purposes

#### BY HERBERT LOZIER

quired The former is more appropriate for objects closer at hand.

After you have decided upon the subject of your first diorama—and it is suggested that you make the first one rather simple begin with a baseboard or floor. It can be



Four stages in constructing a diorama with a curved background. This type

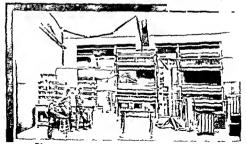


of thin three ply wood. Cut it to shape square or semicircular as required by the subject you have chosen. It is sendericular drill the holes for the wire frame. In either case, a picco of wood must be beveled off and placed beneath the base as shown to give the deared incline.

Next the background is put on the baseboard It is either plywood for the square type or wire screen sud paper match for the spherical type. Ba careful to leave enough space for the frame of glass and wood. When this work has been completed you may start to place the scenery and subjects inside

It must be remembered that all the subjects making up the scene should appear to have depth A feeling of distance must be obtained. The objects in the foreground are always larger than those in the background and the colors closest to the eye pre

Cha es P Stenmetz n'h s Labo ato y 14 w de 7 deep 8 high Alsa by Diarama Carpo at an







is used for outdoor scenes in which great distance or a far horizon must be shown

always the hrightest. All subjects must be cut so they slope toward the rear to give the correct perspective

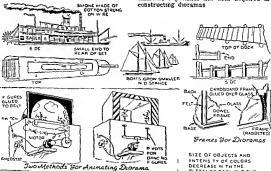
A few of the materials you can use are illustrated but many other odds and ends will come in useful Model airpiane cement is suitable for all gluing purposes

Ordinary plate glass together with card board wood dowels or strips of wood form an excellent frame for the finished diorama It s a good idea to place a length of felt hetween the glass and the set to prevent dust from getting in The frame may he glued and natied directly to the hase and the top may he left open to allow the glass front to be removed. Provide a secure fastening at the top

The lighting is easily arranged Ordinary Christmas tree or radio pilot light sockets may be used Avoid however pointed Christmas tree bulhs which are likely to show below the frame Various colored lights will give different effects and indicate the time of the day. It is even possible with the use of a small motor and a suitable rheostat to have the lighting change automatically

Reflectors should be used with all lamps The center lights should be tilted backward for hest results and the other lights set at any angle you wish

Two methods of making the subjects move are also suggested in the drawings but these too should be attempted only after con siderable experience has been acquired in



D STANCE FROM THE EVE

## HOME-LABORATORY

CUCH simple apparatus as a reading glass, a concave shaving mirror, a short focus magnifier known as a linen counter and a fragment of a pocket mirror, enables a home experimenter to demontrate optical principles of telescopes microscopes cameras projectors and magnifying glasses

To locate the important principal focus' of any lens or mirror, hold a white card at the right distance-called the ' focal length" -to form an image of a distant object. Convex lenses and concave mirrors, alike, can be made to produce either 'real" or "virtual images. A real image can be caught on a screen like the ground glass of a camera. Virtual images are what you see through a magnifying glass, in a shaving mirror, or through the eyepieces of most

telescopes and microscopes, N A refracting astronomical tele scope, a long-focus lens produces an inverted real image and a shortfocus lens is used like a magnifying slass to inspect the image Your reading glass and short focus magnifier, suitably mounted as at left, will make a similar experimental telescope. Its magni fying power equals the focal length of the reading glass divided by that of the eyepiece If the first is ten mohes and the second, one inch. the magnifying power will be ten times EVERIECE

How two lenses are combined to form an experimental telescope

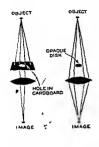
/ITH the same two lenses that you used in the telescope described above, you can construct a compound microscope This time however, the lens of shorter focal

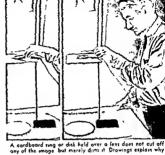
length serves as the objective, or lens nearest the object to be slewed By placing this lens above the object at a distance just beyond its principal focal length, a greatly magnined real image is obtained The eyepiece is brought a little mearer than its focal length to this image, giv ing a virtual image enlarged still further Note that, as with the telescope the virtual Image is the apparent but not the real source of light rays reach ing the eye The accompanying drawing shows how the lenses are placed and paths of light rays.



eversing positions of the lenses, you get king model of a compound in croscope

## TESTS WITH LIGHT





part of the lens go to every part of the

HY isn't a circular shadow thrown on a picture when you stop down or narrow the aperture of a camera lens? With the illustrated set-up, try covering a lens

with a piece of cardboard in which a smaller hole is cut. The image is merely dimmed Now try covering only the center of the lens with an opaque disk. The result will be the same Rays of light entering every image, and either the central or outer rays may be brought to a focus by themselves although they usually overlap. An example below shows an interesting application of this principle in astronomical telescopes



telescope using a concave shaving m nor small flat mirror, and lens



REFLECTING telescopes of great astronomical observatories often have a secondary mirror interposed between the big concave mirror and the sky The smaller mirror directs the image to an observer's eyepiece, outside the telescope. Why it

doesn't obstruct the central part of the image has just been explained by the previous experi ment To make a model telescope of this kind, arrange a concave mirror, a small flat mirror, and a short focus magnifying glass as illustrated For viewing distant objects, the eyepiece should be near the princi pal focus of the shaving mirror The eyepiece acts as a magni fying glass giving an enlarged virtual image of the image produced by the mirror Any distortion of the image will be due largely to the imperfect surface of the mirror Ordinary concave mirrors are ground to a circular. rather than a parabolic curve

## DEVELOPMENTS IN



A clase up of the new elect is eye phonograph in use

#### Strap Binds Condensers

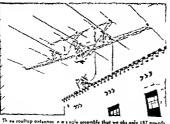
Various combinations of small size tubu lar electrolytic condensers can be combined into a single installation unit for easy mounting with the handy metal straps shown in the illustration at the right Flex thie and soft enough to be cut with seissors the straps are locked with a metal evelet

#### Phonograph Pick-Up Uses Electric Eye

BETTER reproduction of phonograph records is claimed for a pick up recent ly introduced by a nationally known radio manufacturer On the pick up arm a tiny rounded jewel replaces the conventional needle to follow the record groose Attached to the Jewel is a small mirror which vibrates with the jewel and in turn reflects a beam of light against an electric eye. The eye or photo electric cell then translates the vibrations of the light beam into electric impulses in the amplifying c rouit to reproduce the music or other sound of the recording



How the st ap & not seve al condensers into one un t



#### Amateur Builds Triple Antenna for Transmitter

THE posel three laver composite transmitter antenna stop the home of W4EDD a Coral Ga bles Fia amateur weighs only 187 pounds The top section is a five element quarter wave affair for 56 megacy, les The bottom is a similar type for 28 megacycles while in the center is a three element closed spaced array for 14 meg acycles

## THE RADIO WORLD



#### Radio Chemical Kit Aids Repair Men

CONTAINING eight bottles of dif ferent chemicals useful to the ra dio service man the compact kit shown in the illustration above is a valuable accessory on repair jobs Cement polish oiling compounds carbon remover and similar prod ucts are among the materials

### Inexpensive Switch-coil Outfit

REMARKABLY inexpensive an outfit with which amateurs can make their own five coil single switch units to replace plug in tuning coils is now available Coil forms apacers the various switch parts and a buttle of special lacquer cement are included in the kit Additional switch wafers and coil forms are fur nished by the manufacturers at moderate cost



#### Coat-Pocket Portable Set

FOUR tubes are used in the circuit of a tiny new battery powered loudspeaker ra dio just announced As shown in the il lustration at the right the midget set is so small that it is readily carried in a side pocket of a man a suit coat.

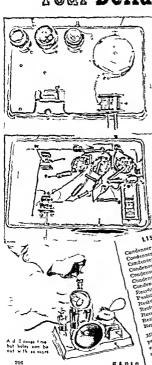
#### Midget Current Inverter SMALL enough to



fit inside many elec tric phonograph cannets the com pact inverter unit shown at the left makes it possible to run alternating cur rentphonographmo tors where only di rect current is avail able The unit is sim ply plugged into a DC house outlet and the phonograph cord is plugged into a socket on the case



## Four Dollars Builds



HEN I fireshed build ing the receiver shown. I dubbed it the 'Economy Three" for it had cost me only \$4 06 not including the cost of the wood for the cabmet. which I salvaged from my work shop scrap pile. It was an easy receiver to build the hand wound coals were easy to make and the parts fitted nicely into the chassis with plenty of room

The chassis I purchased for ten cents at my neighborhood fite and ten It a simply an inverted aluminum cake pan 10" long and 61-" wide, Being made of thin aluminum sheet ing it was easier to work than most chassis materials. In fact, although I used a regular chassis punch to cut the three holes for the tube sockets they could

Top and bottom years of the re ce ver show ng the placement of the ports on the ten cent cakepan choss s The regeneration control sat back from the edge s mounted on a small brooker

LIST OF PARTS

Condenser variable 100365 mfd. Cordenser mies, 0005 mtd. Condenser mice, 1005 mid. Condenset pares 1000 mig 400 c Condenser vuouser three of mid. 4000 Congenses quount mres un mid- 200 1 Condenser electrolytic 5 mids 25 Residen Carbon, 1,000 ohm 1 well Pesistor carbon 2000 ohm. I wate Resider carbon 600 ohm of water Resider carbon, 300 000 ohm Received Carbon, 3 mels, j. 48tt. Resistors carbon two 1 ness, in watt. Regeneration control 32 000 ofth

Mucellaneous Tubes, coll Wire cake ban chassis the uch matheric chest er 200 ohm line-cord resistor on-off SMITCH, SIX PROPER WATER SOCKELS, WITH solder etc.

# This Loudspeaker Set

By FRANK TOBIN

have been cut with an ordinary pair of scissors Because of the pan s sloping sides, however, the 25 000 ohm regeneration control had to be mounted on a small aluminum bracket some distance behind the front edge as shown at the extreme left. The same screws that hold the variable tuning con denser can be used to support the bracket The A C D C cir-

cuit is simplicity itself It uses three tubes -- a 43, a 6C6 and a 25Z5 rectifier-and provides sufficient pep to operate a loudspeaker

cause magnetic speakers are generally aensitive to weak signals I chose one of that type It cost me 93c

The homemade coils are quite easy to wind Before going into the actual construction details however, there is one important point that must be remembered In making the coils, adhere strictly to the



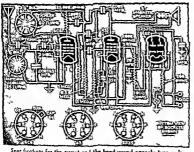
The campleted outfit gives loudspeaker volume with a short antenna

specifications such as the size of the wire, the length of the antenna attached to the antenna coil, the distance between coils, etc.

First cut out two round cardboard disks. one 2%" in diameter and another 314" Then divide each form into seven equal sections and cut a slot down each line about 1/16" wide to within "," of the center On

the smaller form wind 55 turns of No 30 double-cotton-covered magnet wire Pass the wire first over one section and then under the next -- alternating as you go round When finished this will be the antenna coil The larger coil is the tickler coil and consists of 60 turns of the same wire In checking the number of turns, add the turns on two adjacent sections In other words, a coil of 55 turns will have twentyseven windings on one 'rib' and twenty eight on the next

The coils are mounted on the chassis by means



Spec fications for the circuit and the hand wound



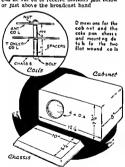
The wire open over and under the form alba

of a brass much ne screw 21, long and two brass tubing spacers 1, in dameter The tickler col should be placed nearest the chassis and 1 from it The antenna coil should be placed 4: above the tackler coil Refer to the drawing below for details

The cabinet whose dimensions also an rear in the drawing below can be made of any wood that you may have in your scrap ple It has an open back and the chass s can be conveniently held in place with two screws driven into the baseboard.

A 25 antenna should be used and it can he left on the floor or hung out of a window On my version of the set I used rubber insulated stranded wire and it worked particularly well If a longer antenna is desired a 00005 mfd fixed mica condenser must be inserted in the antenna lead

By adding to or reducing the number of turns on the antenna coul the sets range can be var ed to receive stations just below



## More Power

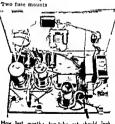
AST month as the first in a series of sex articles on easily built circuits for radio experimenters a two tube all electric receiver was described This month a stage of resistance coupled audio amplification will be added to give

the set more power For the additional stage we will use the triode section of the 25B8GT tube used in the original design and six new items from the original list of parts. The new parts consist of a 002 mfd. mics condenser a 200 000-ohm 1- watt resistor a I megohm 12 watt resistor a Fahnestock clp for the ground connec tion and two fuse mounts to hold the resistors The 002 mfd, mica condenser is used for coupling the detector stage to the audio stage and is mounted on the baseboard in a vertical position. In the photographs it can be seen next to the antenna chp The two 1, watt resistors are also mounted on the basehoard next to the other resistors.

In order to avoid feed back and un desirable oscillation the grid lead to the

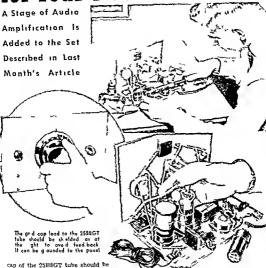
#### LIST OF PARTS (Included a lost month a lat)

Condenser mica 002 mfd. Resistor Carbon 200 000 ohm }- watt Resistor earbon 1 meg 4 watt. Fahnestock clip



How last months two tube set should look after adding a stage of audo amplification

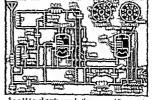




of the shielded type The 006 mfd tubular condenser

connected in the first des gn be t veen the plate of the rectifier tube and the ground is now used for adding an outside ground connec tion to the set The 006 mfd con denser isolates the outside ground from the ground wir ng m the set

An indoor antenna 20 to 25 long is all that is needed with the audio stage If a longer antenna is de s red a trimmer condenser must be inserted in the antenna lead. How to build one from scrap parts will be described in the next of this series of articles



Sx add t and parts provide the new amplifier a rout



As Easy as ABC

The DELCO ELECTRO-LEVEL

Prevents Over-Filling

Remove the vent plug . . . and automatically the new Delco battery Is protected against over-filling. Why is this protection important? When a battery is being charged, pressure is built up inside the cells by the gases which are released. These gases should pass freely through the vent holes; but when the electrolyte level is too high, acld is sprayed out. The acid corrodes the battery carrier and connections.

The secret of the automatic protection provided by the Delco Electro-Level is a sliding raire which drops down to form a water-sealed air lock when the proper electrolyte level is reached. When the plug is screwed in place, the raire is lifted to form an efficient



baffle arrangement that breaks up acid spray and allows only gas to escape.

Delco batteries are original equipment on 43 per cent of all new cars sold. For sure starting ability and dependability, replace with a Delco battery.

#### HERE'S HOW THE NEW ELECTRO-LEVEL WORKS



Vent plug removed for filling—valve forms at lock when electrolyte reaches proper level. Notice particularly the water seal formed when the edge of the valve drops into the fayer of water retained in the ridge around the valve seat. This layer of water is replantable by condensation, eliminating any possibility of a leak in the aff lock when the lead valve is in position for filling.



Vent plug screwed in-valve is rulsed to permit escape of trapped air and gases from the cell through the passets and the vent hole in the plug hotice here the efficient builte arrangement through which the gases must pass This condenses mousture and breaks up the add ayray which might otherwise escape to damage the battery carriers and connections to the battery.

## Delco-Remy

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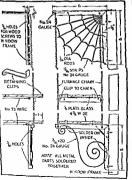


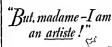
"PRESTONE" Anti-Freeze `There's nothing else like it"



## Window-Shelf Brackets of Spider-Web Design

PLATE GLASS hanging window shelves ave become popular and a decorative arabigement can be made inexpensively as hown The supports are of 24 gauge galanized sheet iron (Continued on page 214)





"Who, me?" said I, when this housewife asked ine to polish her car for my victuals, "A retired impressing?" Whereopon she just han led me a can of polish and said, "No work, no food get; fusy." Which I did, for just then



imagine my joy! Why, this poil himparted a dazin g thine with scarcely more effort for me than when I wielded the batco for the Ilohoten Philharmonic! 'th, No 7," I sail, examining the can my favorite number!' Then I saw that it was "made by Du Pout"

"That No T Pelsth," I confded, as I topped off my steak with a slab of pie, is made by the same people who made the 'Duco' finish for my lost three sown care No worder at bestone such a lustre' \nd ning it left me so full of vayor I d be clarmed to chop some wood for you, Madame"



## DU PONT Nº 7 POLISH

made by the makers of DUCO\* and DULUX\*

# WANTA SAMPLE? Du Poot Dept 6 SF, Wilmington Del. Seel June a sample of No 7 F Judy— on hf r frood and fin size a Funchase 6g to help ower n s ling costs.

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the non inflammable cleaning fluid which leaves no odor.



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THERE S no guesswork with these rings be cause each Engineered Set is specially made for one particular make and model of car and precision installed accord

ing to blueprint instruc tions That's why these rings will stop oil waste and prevent blow by in your car And each ring is Altinized-an exclusive McQuay Norr s feature-to

give long life and reduce wear McQUAY-NORRIS MEG CO St Lous Ma

1" wide folded to an angle with 12" legs and 1/16" diameter iron or brass rod Com mon furnace damper chain is used to hang the 14" plate glass shelves

The top brackets are shaped to resemble a sp der s web. All four brackets are per manently screwed to the window frame As many intermediate shelves as desired may be hung d rectly on the chans Each shelf should have two 22 gauge steel wires run n ng lengthwise to act as a tie wire so that the shelves will not accidentally drop from under the end angles while being cleaned. Spans longer than 36 reguler heavier plate glass or else should be lightly loaded

The metal may be gilded or painted flat black The gilt is pleas ng with dark window frames the black with ivory or cream frames -CARL F H SCHRADER.



#### Mounting Tissue Tacked with Soldering Iron

WHERE dry mounting tissue is used for sticking photographs or drawings to mounts, the tissue usually is tacked in position first so the edges can be trimmed and other operations performed without its al pping The tacking is done with a warm blunt posed tool Such a tool can be improvised quekly from a small soldering from and a piece of sheet copper -- W E B

#### Quickly Made Wina Nut



RECENTLY I needed a " wing nut but none was on hand or could be purchased in the neigh borhood I made an ac ceptable substitute from an ordinary 12" hexag onal nut First I drilled a hole in one of the sides and tapped it then I cut the nut in two z little above cen ter and also cut down and filed the sides to shape -FRANK GROSS

## You may worry about the plumbing



## but here is one worry you can avoid

With proper care you might have avoided the worry of that leaky pipe. That s true about classis lubrication too.

A haphazard job with ordinary grease.

An inspiration to with ordinary getase means early repair bills. That's why it is important to remember one word "MARFAK," which means our 40 point Chassis Lubrication Service. We are trained in a special Texaco Lubrication school. We work from a special Texaco Lubrication Gude so we don't miss a point on your car. We use Marfak lubricants. They last twice as long as ordinary presses.

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#### FURNITRE

sinct with automotic light in top nine F replace Serren and Trinket ding Copies of Popular Scence en Found Top Stand a Co enist 187A 187A with tripod base 247A of or Occasional Table

216

# GOOD LICHT

## the most important tool in your Home Workshop



## TRY THESE TIPS to get more out of it

2. in a small home workshop you need at least two 150 watt G E MAZDA lumps in RLM redectors. Be sure to mount un its ner front edge of bench, not hallway from front to back, you'll see pencil marks better

2 For better Fight, pur a 150-wart Silvered Bowl G E Mazznalamp in each reflector. The murror silvered reflector built into this bulb gives you generous diffused light for easier seeing

3 In a larger shap you need more of these units. To have even lighting along the work bench the distance between units should not be more than one and one half times the disrance from unit to bench.

4 For flexibility some workers like this troller lighting system Lighting units glide on a live but protected channel commercially available to bring you light where you want it.



job in workshop of home becomes easier with a handy utility light like this a G E MAZDA Reflector famp in clamp on socker that helps you put light wherever you need it.

7. Avoid brouble save steps and time Use G E MazDa lumps (10c) to inducate live tircuits warming that your glue por is on telling you upstairs that basement and bench light are on

8 Be sure that the lamp bulbs you use for your home workshop and all over your house are G E MAZDA lamps the kind that are made to stay brighter langer





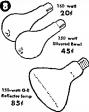


# GE MAZDA LAMPS GENERAL BELECTRIC









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ASS PIEES-Detroire the file to I no at we by an an increase of the file of the



19 Acers Street Providence, R J Send free book, "A File for Every Purpose,"

#### Plans for the Workshop

(Continued from page 216)

#### BOATS

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Lindsmart driver 202 D7 350 329 12.

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#### MISCELLASEOUS

Aluminum Trimmed Oberes Try Lette Operation 1990 -

LEAFLETS AND BOOKLETS

Hiola on Cuttier, and Drijling Glass
Hopse Workshop Index to 1838
Howe Workshop Index to 1838
How Workshop Index to 1839
How Workshop Index to 1839
How How Index to 1839
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How Index to 1839 Workbenches and Tool Cabinets (leaflet)

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## SHORT CUTS FOR THE



· Here san easy way to produce that attract ve design called spotting of frosting usually seen on the backs of warch movements or on the beds of fine lather You simply give a disc of leather or felt on the end of a short piece of dowel rod and charge it with fine Cathorundum Brand SI con Carbide or Aloxite Brand Aluminum Oxide Powders Then place the dowel rod in the drill press chuck and revolve at slow speed. When the charged up is brought aga not a pol shed meral surface a series of fine rings will be engraved in the metal. These rings or discs arranged in orderly rows

produce the desired effect.

Alk your hardware feder or m.B supply house on shower or the complete is ed by the complete in th

Wr to Dept \$ 100

THE CARBORUNDUM COMPANY

\tagara Falls N Y

and industry many action by The Larbartanian Company

#### Copper Keeps Tree Roots from Entering Droins

TO STOP tree roots from entering vitreous (clay) sews the mlz 10 senume copper bromsing powder to 100 lb of the dry mortar mix used in laying the pipes As soon as the mortar cracks through settling or other in jury the embedded copper becomes exposed and quickly acquires a coating of base copper acetate. Although this is insoluble it in deadly posson to tree roots coming in contact with it and prevents further growth.

Copper powder sprinkled over the so called hot dog type of asphaltum packing has the same effect in stopping the entrance

of tree roots into the joint

Where trouble with free roots is anticly pated with severa already laid without this type of protection three parts from and one part of copper may be mixed throughly with a size to a thin creamy consistency then dissets of four or five times its volume than dissets of four or five times its volume and the size of th

#### Powdered Rosin Helps Hold Turned Work in Chuck

Ross, crushed to a fine powder forms a good bander when necessary between turned work such as wooden bowls trays or boxes which have to be finished by the so called word method method and the hollowed wood en chund method and the hollowed wood en chund method and the hollowed wood with the same of the work and the work with the altered yourned part of the work have the work in the same of the work and the two are stated part of the work and the two are stated part of the work and the two are of the work is then ready to be turned with out danger of stipping—2 B.

#### Old Phonograph Record Serves as a Sanding Disk

I HARE found an old phonograph record makes an excellent disk sander when used on a circular saw mandrel The record should be fairly thick cheap thin records are use less for the purpose. Print cut the record the same diameter as the circular saw and on large the small criter hole to fit the saw cannot be compared to the same diameter as the circular saw and on large the small criter hole to fit the saw cannot be compared to the same diameter of the same diameter of

# Here's the perfect 10"BAND SAW for your Workshop

### Inside Secrets

"PRE-LOADING BALL BEARINGS"

Delta ball bearings are pre loaded to make Delta machines more accurate in operation. Here a what this means to the prospective pur chaser of power tools

In the design and manufacture of ball bearins it is pract callly impossible to remove all of the play or clearance. In other words a per feetly close fit between the ball bearing and the races in whe fitter run cannot be obtained. This play is not visible to the taked eye. It can only be measured by means of accurate instruments.

accurate instruments. Yet, this extremely small variation will keep the bearing from running absolutely true. In a drillipress it will cause a fine drill to wobble from side to side. In a shaper it will make the knives rise and fall producing an uneven cut.

ducing an uneven cut

Pre load in ball bearings as practiced by Delta el minates all of this.

The method used in holding the bearing in all Delta tools puts a definite amount of pressure on the bearing races so that the ball bear link ride as not both of the

bearing races so that the ball bear ings ride aga not both of the races all of the time. Notiber the inner race or the outer

Neither the inner race or the outer race can shift out of place—they are always in the same position. This means that it is impossible for the bearing or the shaft which revolves in it to run out of true. Thus you always have uniform accuracy in Delta machines.

Deta machine.

If you want the best in power tools be sure that the bearings are pre loaded." Have the salesing demonstrate it to you and prove to you without a doubt that the ball bearings are pre loaded.

Pre load ng is another superior exclusive feature of Delta tools—a feature not vis ble to the naked eye —a feature too often passed over lightly yet one which is of vital importance to you.

• The massive design, advanced engineering, theroughly studied design and accurate construction of this machine make it the finest 10° band saw ever oliered to the criffstram. Its expectly under the guide mixes it the equal of an exceptionally rugged heavy frame, double-scaled ball bearings hibricated for life, heavy cast rom 11° 4.3 It lable, incrementer adjustments in upper and lower guides and many other features. Some of its sencifications in close 3.7 front to hash. Captury 10° hade to upper arm 6° under guide Accurate the proper arm 6° under guide.

23' front to back Capacity 10' blade to upper arm 6' under guide Accurate true-running balanced wheels, carned on self sealed New Departure ball bearings—lubricated at factory

for their entire life Heavy accurately ground main shaft Micrometer adjustment upper guide Each adjustment independent of others and each made with precision Micrometer lower guide, with adjustments brought out to front of table. Operators hands never one near blade. An exclusive feature Unper

wheel tilting device and tension scale similar to that used on 14 'band saw Bolt wheels and blade thoroughly guarded, only portion of blade actually used for cutting is ever exposed For full details, pices on this and other Delta tools, fill aut the cutton.

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BY THE MAKERS OF MOBILOIL

#### Improved Way to Fasten Floor of Stock Truck



When the floor of a stock truck becomes worn the boltheads are left projecting as shown at A, which makes it difficult to clean the floor since the shovel continually

tions  $A \le cd$  way to avoid thus difficulty is to lay the planks as at B with the bolts coun tersamk considerably below the surface and then fill the holes with molten lead. This provides a floor that remains comparatively smooth because the lead being quite soft wairs down with the wood—W J W

#### Point Thickened with Whiting for Cooting Cracked Boards

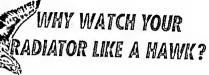
THE saling or weatherboards of an old house were cracking and many knotly places had aghit radially like the cuts in a pee Affect ruying several different ways to make a presentable job of repainting the building at the flowest possible cost I finally solved the problem by adding whiting to a good grade of house paint. The paint was mixed thick enough so that it would not run out of the cracks but not too thick to address well to the rough surface—MAURICE GORE

#### Furniture Costers Need Oiling to Prevent Corrosion

IF THET are neglected for years casters on beds and other heavy pieces of furniture may become so corroded and stiff that they will netther swived hor roll and the floor then becomes badly marked up To avoid this take out the casters occasionally and put a little heavy oil or periodation of the spiedle or bearings and on the punion of the roller—H. W MATTHAES.

#### Checking Cracks in Plate Glass

WHEV. a plate glass window becomes cracked but not so badly that it has to be replaced it is desurable to take some steps to prevent the crack from extending. One way to do that is to score an are about %. In different to the control of the contr





## BE SAFE ALL WINTER LONG WITH "PRESTONE" ANTI-FREEZEI

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## DO YOUR OWN DEVELOPING



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224 Place a me Foretan Scence Monthly when writing to ad cet at a

#### Camera Shoulder Strap Kept from Slipping

THE shoulder strap of an ever ready camera case has a tendeucy to slip off. To give it a positive grip on your shoulder cut a strip about 2" by 8" from a rubber stair pad or discarded inner tube. Make a pair of slits at each end and thread the strap through them as Illustrated—RAY KENSCHYER.



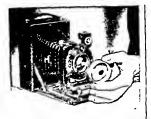
A rubber shoulder plece a added to the strap

#### Brass Wire Stiffens Tube for Print Washer

WHEN pruits are washed in an ordinary tray with the aid of a rubber hose it is an unprovement to unsert a piece of briss or unprovement to unsert a piece of briss or if can be bent as shown below to fit around the bottom of the tray Very small holes are cut at latervels in that part of the tubing which will rest in the tray and the open end is doubled back on itself and bound with a present of atrong cord or brass wire if the present atrong cord or brass wire if the property of the provided the provided that the provided the provided that is not a provided that the provided that th



Pecc of at if brass or other nonrusting wire
rating to all crise: POPULAR SCIENCE



#### Lens Partly Covered to Get Soft-Focus Pictures WHEN high-



ımage becomes sharper because the center of the lens is generally freer from optical faults than are the edges By using this principle in reverse - blocking off the center of the lens and using

speed camera lenses are stopped down

considerably, the

only the edges-beautiful soft focus effects may be obtained

A device for achieving this can be made in a few minutes Just cement a thin disk of black paper to the center of a clear, thin piece of transparent cellulose wrapping ma terial Clamp the edges between two strips of cardboard rolled into a sort of embroidery frame just large enough to fit the lens mount. The black disk should be beld as close to the lens as possible, and must, of course, be smaller than the diaphragm opening used By using disks of different sizes, various degrees of softness may be obtained. The increase in exposure necessary may be calculated by subtracting the area of the disk from the area of the camera aperture

#### Oars for Model Lifeboats

AN ADDED touch of realism may be given to lifeboats and dories on ship models by lashing sets of oars across the thwarts For very small models the oars may be shaped from toothpicks Lash them in place with cotton thread that has been dipped in strong tea to color it.-P. H. S

## Can You BRING BACK November?



WHEN November blasts whistle around the chimney corner, you'd get a real thrill from movie scenes of your youngsters at play last summer How fast they grow up! You can hardly believe your own eyes. And in a few years those scenes would be priceless

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#### Small Graduate Measures Liquid Chemicals

A SMALL graduats for measuring very small amounts of photo solution concentrates strong acids and the like can be made from an empty ½ oz glass M Q developer tube A strip of waterproof ad heave tape is fastened to the side and marked off in five 1/10 oz divisions.

VERY old negatives somatimes have large patches of yellow stain that cannot be removed by any sort of bleaching process. The best way out is to make a positive in the enlarger by using a G (yellow) filter on panchromatic film or plate. From the positive which will be free from stain make a new negative—E B DENYISON.

#### Spring Clothespin Keeps Prints from Cloquing Drain

When a drain of the type illustrated is used over the outlet of a darkroom sink for washing prints an ordinary spring wooden clothespin applied as shown to the overflow tube will keep prints from floating over and clogging the drain—SUNEY R BAYNE



The clathwap is projects up from the sink outlet and prevents prints from floating over the drain

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#### Bombers or Battleships?

(Continued from page 56)

our Navy as engaging any enemy fleet far out on the high seas where land based planes play no part in the combat It would be the carrier planes of the two ficets that would fight it out in the air while the sur face craft joined battle below So far as carrier based dive bombers or torpedo planes could shake off attackers and damage on posing warships so much would that con tribute-even if not decisively-to the ulti mate outcome of the engagement But it would be joint action by sea and air that counted whether it was an air bomb or a shell that finished off a bostile vessel

So from our own viewpoint air power and sea power become merged into one Taken separately neither one completely as sures our security Reenforcing each other they constitute a mighty defense team to safeguard America.

#### Robot Bombardier Drops "Eggs" in Patterns

Bours are dropped automatically at regu lar intervals to fall on evenly apaced points on the ground by a robot bombardier in vented by Ralph L. Bell of Raspeburg Md The machine automatically takes into ac count the ground speed of the plane

Electrical Impulses release the bombs from their racks after the pilot has pressed a button or when a bomb sight is aligned with the target. Control is accomplished by a motor connected to dials which have previously been set to correspond to the speed of the plane and the intervals at which the bombs are to be dropped

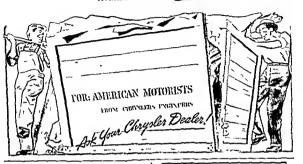
Once the device has been started it con tisues to drop the bombs at regular inter wals until the racks are empty enabling the deadly eggs to be laid as closely or as far apart as is required by the nature of the target.

#### Gauges Speed of Plane

GREATER accuracy in antialreraft fire is said to be obtained by the use of a new instrument which gauges the speed of an approaching plane When the height of the craft above the ground bas been de termined by other means the observer sights through the device and counts the seconds while the planes image passes between points on a horizontal line The planes speed can then be determined by consulting a scale

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#### More Guns for Our Army

(Continued from page 61)

at the rate of fitty five or saxty miles an hour as long as it has a clear road A long day a search for horse-drawn I ght artillery is thrity miles truck drawn light guns easily can do 175 miles a day Horse-drawn artillery can keep up with foot slogging doughboys and marching horse cavalry truck-drawn guns can keep up with tanks and motoruced infantry

Field artillery isn't of much use without the auxiliaries which make it possible for it to fire accurately. The men at the guns seddom see what they are shooting at their fire is directed by officers in observation posts connected with the baileries by tele phone or radio and often is corrected by observers in airplanes or ballooms.

One of the most valuable artillery auxil insies is the observation battalian. It is the most highbrow outfit in the Army. Its buck privates chait about saymptotes and its and come lave on intimate terms with the bit cannot be suffered to the compart of the comp

We have one sound and flash observation battal on in our Army The Germans have one with each of their divisions

We also are short of atrylance especially designed for the spotting of artillery fire and of the successful C 6 motorized observation balloon which equipped with a detachable undercarriage with an arrpiane engine and propeller can move from one place to another at a speed of fifty miles an hour

But most vital is the Army's need for more guns with which to do its national defense job. O'ficial sigures are not obtain able but it is doubtful that we have more than one eighth the number we should have Deciding on just how many guns and just what sort of guns the Army needs is the Army's job. Making sure that the Army gets those guns is the job of every American citizen

#### New Garand Rifle Sight

John C Garand inventor of the Garand semiautomatic rifle recently adopted for the US Army has patented a new and in proved front sight for the weapon. The patent is assigned to the United States



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#### Seventeen-Year Locusts

#### (Continued from page \$5)

Insects with similar habits and even with Ws on their wines are known to appear in the Ural Mountains of Eastern Europe Another mistaken belief which has been given wide currency is the idea that adult cicadas never take nourishment. It has been demonstrated that in at least some cases they meert sharp little beaks into plant tissues and drink sap However, the damage caused by these insects is negligible

Recently, scientists have begun a new line of cicada investigation the study of their little known activity below ground. At the University of Kansas Dr Ray mond H. Beamer is now raising cicadas in tubs of dirt in which goldenrod roots supply the needed ean Out of such researches may come the discovery that even the socalled annual ciceda the familiar noisy green dog-day hervest fly may take more than one year to develop and that all co cadas are really periodic, each heving its own cycle of years needed for its develop ment

In any case the seventeen year variety holds the record for the length of time required to reach maturity. The successive appearances of these masets form a sort of slow motion insect clock recording time in seventeen year intervals. Only twenty six times has this clock completed a revolution since Christopher Columbus discovered America Only eighteen generations of the cicadas have appeared eince the Pilgrims landed at Plymouth unly ten since the American Revolution and only four eince the Civil War Although each brood of the seventeen year cicada in northern statesand the thirteen year cicada in southern states-requires its full period to develop there are different broods so that every year, somewhere in America periodic cicadas are appearing. The present widespread brood Number XIV, is celebrated as the one first seen by white settlers

As this is written, pale anticke creatures are already hatching from the eggs laid in twigs by the female cleadas. They are dropping to the ground and disappearing from aight, beginning again the cycle which last commenced in 1923 Vast and sweeping changes-elections wars scientific advances -will occur during the years they will burrow through the darkness of the soil Then as though at a given signal in the year 1957 they will tunnel upward to the surface That emergence seventeen sum mers hence will complete once more the strange cycle of their astonishing existence

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If a coarse thread is used an a part of small adometer it is likely to weaken the care sa it will not stand the strain of the cut. For this reason a multiple threading operation rather than a coarse thread is adoitable when a mare rapid advance is desired than that pravided with a standard thread.

There are many ways to reduce manufacturing costs. For example a miling machine hand had seven minutes to woste for every prece being antomatically machined to a small drill press was installed nearby to keep him bays It proved prafitable to bath emplayee and employer

A new kind of paste makes prussion blue seem an ant quated product for testing scraped ground or lapped surfaces with master gauges

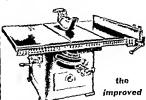
A manufacturer of a certain machine gun is reported to have said that 101 lb of raw ma terials are required to praduce 18 lb of finished parts From a 1940 manufacturing paint of view something appears to be decidedly wrong

A laol past grinder often propos useful in connection with a shoper but I recently discovered that an electric drill doesn't take a back seat in this respect either. If you use your intentity you can devise several means to brace it on the taol past si de.

The way oil is splattering around strew machines and turnet lattes in some plants, one would think that cutting oil casts no more than water That accounts for certain operators who would laok better with rubber boots and an umbrelle Others doing the same work are able to wear a white abron.

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It's a trick from the old school but you on detect audibly the removal of even \$0005 'stock while threading internally Attich fine music wire to the external surface of the work, connect the other end to a mall cylindrical cardboard box, and use it as an ear phone -H J C

#### Toolmaker's Clamp Acts as Small Lathe Dog

An orothary toolmakers clamp can be made to serve as a lathe dog by fastening a bolt in the faceplate of the lathe to drive it, as illustrated -C W W





Try this yourself next time you start a job that calls for working in metals, use Kester Metal Mender for all metallic joints.

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#### Miniature Leaded Windows Made from Photo Film

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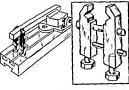
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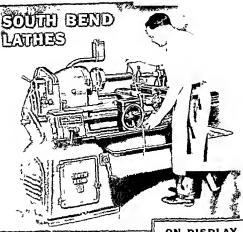
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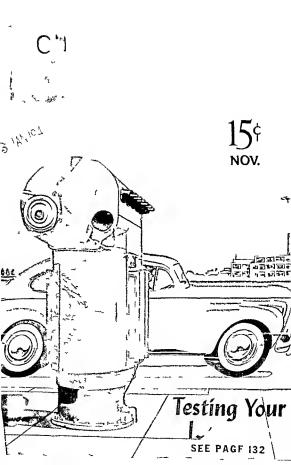


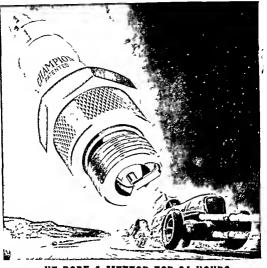
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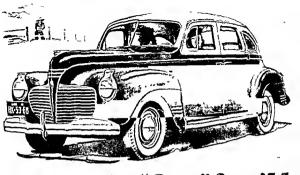
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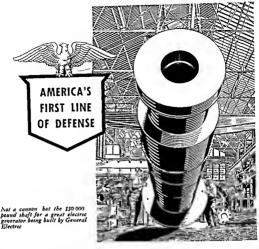
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For the last two years I have been in burthers for myself near last been in burthers for myself near mostly. But mere has steed by Incorered. I have NE I to thook for my start in jule field ARLIE J ROLINER 300 W True Ave.



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# Our Readers

#### Should Plane Windows Be Bigger for Such a Big View?

As an appreciative occasional user of our air lines I have no complaint against the splended service they all render That they are sale to use is attested by the records That they re fast no one can dispute. Coni fort service individual attention at every turn and last but not

about the most at tractive way of get

least a remarkable MAY HOT A SUNDECK P economy all comb ne to make flying just



fuss to be one of those blase passengers who resd a book from the time they take off until they land Without an apology I confess that I sit and stare out the windows (\*) with the unblushing enthus sem that a visiting fireman displays for the big city a tall buildings Something should be done to change those tiny portholes into first-class show win dows Maybe some air ins offenal will ex-plain.—D S Montelair N J

#### He Might Lend It to the Solesman Who Sells Strow Hats to Eskimos

By THIS time millions of electric fans in hundreds of thousands of offices and homes have been turned off and put away for

WELL WE USED TO PLAY PUT IN TAKE WITH IT



another summer Talk about wasted potential energy! The guy who can think up some way to "put it to work" the year round will really have something The big electric companies would have something too, and so would their employees and stockboiders in the way of increased profits from increased sale of electricity If

all the fans in the country were made to turn the year round Oh well. Who wants to borrow my electric fan for the winter? I don't know where to store it in my one and a half room apartment.-T R, Troy N Y (Continued on page 14)

#### Don't Jump to Conclusions on That Jumping Brick

Masse Im sust a killjoy but Im afraid that all the work of the mathematician Perrin mentioned in the letter of A. G B., of Sacramento Calif., about the brick that on certain rare occasions might be expected to tumn up in the air when its atoms not out of whack was done in vain. He made his mis take when he got the impression that the atoms move every way at random. It so happens that each atom moves in a straight line until it collides with another atom then the two bounce off of each other Therefore if an atom is moving straight up there is bound to be one moving straight down If this were not so there would always be more atoms moving in one direction than another and the hrick would always be either sliding around or jumping up and down No doubt, he has noticed that this does not happen. While I am at it, how

about a bigger automobile section? We all own cars Why doesn t Gua Wilson have a \*Questions from Auto Owners column' His articles are tops Hes the guy who got me interested in automobile repairing -A. J H. Lynn Mass



AH BUT SENOR HOW

A bigger automobile section that should in terest A J H and countless others who have requested at will be found in this issue and those to follow -Ed.

#### A Reader Explains

#### the Exploding Lamp Chimney

In pecaso to A. B. H s exploding lamp chimney I am not a "reliable glass factory as be mentions but I can offer a possible answer to the question of what made the chimnes go to pieces Anyone familiar with chemistry has heard of "Rupert's drops used for a novel experiment. They can be thrown around and will not break until the surface is scratched or cut. The reason is that they are made with a very thin but tough akin, while maide the glass is under tension or pressure. The iamp chimney was probably under the same strain and when it cooled-probably irregularly because of a



## HOW A BALKY CAR WAS MADE TO RUN SMOOTHLY BY ONE SIMPLE CHANGE







tar had the rivers. The motor wed backfired and bucked like a acho it had no power on the hills. I do a figure what was wrong until—

A SERVICE MAN PUT ME HEP to Auto Lite Spark Plugs They II g ve your car new i te "he sa d "Those old plugs now waste plenty of gas that costs you mone;

RUNS SMOOTH AS SILK ROW! Viy motor purts like a kitten. And say live sure cut my gos b lis a nee l put those new Auto-Lite Spark Pluss to work for me

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Ignition Engineered by Ignition Engineers

Spark Plugs NOVEMBER, 1940

## Our Readers Say CONTINUED

sight draft-the strain became too great at some point and the whole thing went to pieces -J A W Oberlin Ohio

#### There Are More Ways Than One of Getting Fish out of Water

YESTERDAY I decided to clean out my very heavy tropical fish bowl Under the heading Car Tips for Amateur Mechanics in a



recent issue I noticed that to draw gasoline from the car tank you can use a rubber tube wrapped around and then removed from a clothespin to start the siphon I decided to try it on my fishbow! and it worked perfect iy Th s prevented me from getting durty and fishy water in my mouth Thanks lots -R W New York City

Afraid that R W wasted time The method he used is fine for car gas tanks and other narrow-top conta ners But in an open boul the easiest way to etart a siphon is to submerge the rubber hose until its full punch and withdraw one and and lower it below the water lns Ed

#### Either You Get o System or You Don t Get Pictures

UNNUMBERED other camera fans are probahly writing to sympathize with T U of Columbus Oh o besides myself It's no joke to spand hours taking pictures with empty film holders T U what you need is system and it is something that God didn't give you You either get a system or you don t get pictures There are a lot of practical ways if you want one

You could weigh each film holder before you used it If it s loaded it would weigh more I never tried it but it should work You could snap a rubher hand around the empties which should work un tli Junior wanted to make a model air piane I still don tthink you are in such trou

You have the films You have the kid Ill bet Junior had a runny nose that day anyway Maybe he poses better when there isnt any film in the holders Seriously did you ever try shooting pictures without film? Say now there a an idsa Cheap soul satisfying and the kids always pose hetter under those conditions Try it some time Then just to cross the kid np have say three films ready right at the snd -R V S Burlington Iowa

#### A Slightly Gruesame Math Problem for Budding Generals

Your magazine is so darned interesting that once I start to read it I can't put it down until I we read it completely through Then I



have another month with nothing to do but reread the book about ten times over Your new arrangement is swell and it helps us to look up back ar ticles with very little Speaking of trouble articles, the one start ed recently on radio for beginners is tops And now I have a problem that will

amuse you while you re waiting for the second half of some Saturday afternoon football game to come in over the radio hut should leave you time to spare to hear the changes in the line up Hers it is After a repulse a general found that only 5 400 men more than half of h s former force were fit for service as 400 more than one fifth wers wounded and 500 more than one eighth were killed missing or prisoners What was his force before the battle?-A. D N Vancouver BC Canada

#### What Bothers a Lot of Us Is Moking the Dorn Stuff Grow

Haring absorbed an untold number of ideas screwy and otherwise-from this column I would like to submit one of my own leaving it to others to decide which heading it be-

longs under The heat of summer makes a mans whiskers grow faster than they do in winter Supposing you stayed in a place that was air conditioned Would that retard the growth somewhat? If so would it he possi hle to prevent the growth antirely by ilv

ing in a very coid place? Or perhaps kill the growth hy sud

dealy thrusting your face into a cold cham ber sapecially made for the purpose? Such a machine could also be used to rid women of success hair on their legs and with certain (Continued on page 16)



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## Our Readers Say CONTINUED

modifications it could take the place of a haircut. As you can see the possibilities are end less —J S. Yonkers. N. Y.

#### He ll String Along with Mager, Hook, Line and Sinker!

Was amused at the story about the conversational caths, on page 127 of your October sause that talks on the rad o When removed from h. c') tank in the Staten Island 'N Y son the story ran the fish small of the part of an attract of the story ran the rad part of a natural history program that was sent out from a New York radio station Imagine my surprise when I turned over the next page to Gus Misers 2 UN Natural Het sequence of the State of th

Mager was right and so was the fish story note that and ng Croakers for example are defined by Webster as "Any of various fishes that produce croaking or granting noises as certa n grunts and earf fishes" The noise occur when the fishes are out of water—Ed

#### He Wouldn t Worry About That When the Bombs Storted Falling

TRE



The September Issue of PSM was certain by a honey I want to compliment you on your cover and on the career of David Sar noff I have just looked at With the Inventors and Readers Say The letter from M I. Z about the new invention of the sold discrebenders.

diers helmets that bounce the bullets vention of Andre D Amico in With the Intervention of Andre D Amico in With the Servention of Andre D Amico in With the Amico in the ground as a protection against acreal bombs What would happen if the concursion of a bomb happened to break the hydraulic plunter or if I time so of at rowerd the root so had the weight was no great that the plunger would be so that the weight was not read that the plunger of the control of the control of the servential that the serve

#### This Should Fold Up the Umbrella Problem

The answer to P M D s problem about the partially open umbrells is 10° 18 By con structing a triangular pyramid the base of which is at right angies to the center stick of the umbrella, with two of the ribs forming that other sides it was easily worked out. A

line was drawn in the base perpendicular to une side of the base and continued up to the apex to aid in the solution—J V., Montrose

## The Navy's Own Mascot, Complete with Whiskers and Horns!

The Navy certainly was thinking of its today them one it today them of the today them of the today them of the today them of the Navy them of the Navy them of the Navy mascertainly gives the Hifelike impression of the Navy mascet the billy goat complete with whiskers and horns I wonder if the Army goes around



with mulea on its tanks "-S Z Fairfield Conn

#### Reader Points Out that Almo Was Not o "Seeing Eye" Dog

MAY I call your attention to as attention aplar I call your attention to as missing to your magazing referring to the first dop brought to this country to guide the bind? Almo was not the first Lux von La Saile was the first dop brought here from Europe for country at the La Sule Kenneds in Minnespoies Minn for the lets Senior Thomas D Schall Almo was a Masters Eye dog and not a Seeing Dys. The Sening Dys repretation of the Senior Se

We're glad to have this case of mistaken identity cleared up -Ed

#### There's Still Quite a Gap, Still, It's Quite a Collection

In THE has few lasses of your magazine. I have become interexted hawhat the read
thought maybe it
would be of interest to
these readers and per
haps to yourselves to
know that I have kept
every issue of your
magazine from October 1334 to the present,
which will very soon



make seventy two copies all in perfect con dition I have secured issues of your maga zine moreover from 1872 to 1874 bound in four volumes.—P A. H. Minneapolis Minn-

## THE DELCO ELECTIO-LEVEL

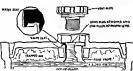
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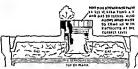
#### OVERFILLING

When the electrolyte level in a battery is too high, acid is sprayed through the vent holes by the pressure inside the cell ... pressure that is built up by the release of gases when the battery is being charged. This acid spray attacks battery connections and battery carrier. The new Delco battery is protected against these conditions by the Delco Electro-Level, which automatically prevents overfilling when water is added.

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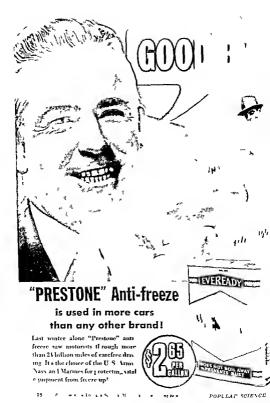
lent plug stressed in—whee is raised to permit secane of rapped as and gases from the cell though the passage and the vent hole in the plug, hotice here the efficient boffle arrisingtement through which the gases must pass. This condenses ministure and breaks up the soid spray that the condenses which the through the battery earlier and connections to the battery.

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# Anti-Freeze

## With the Inventors

CKATE from the street right out onto the ice pend This is I terally possible with a pair of double duty skates invented not long ago by Louis M Friedmann of Chi cago Ill Having roller skate wheels on one side and an ice runner on the other a unit



that fits sough in to clamps attached to the foot plate of each of a pair of skatea can be quickly reversed depending on the type of skating you intend to do Thus the user can put the skates on at bome skate on rollers to the side of a frozen lake unfasten the re versible roller units replace them. with the runner g des down and ba ready for a whirl

on the ice NEARLY ALL so called patent medicines are not patented at all but covered instead by reg stered trade marks TO PROTECT GROVES OF FRUIT TREES from hot state electricity carrying wind and dust John Del Rea De Land Anaheim Calif inventor has devised a system of wind deflectors and static antennas that is said to prevent the burning of foliage common to bot climates Vertical louvers deflect the wind a deways



against a system of horizontal louvers which force it upward to clear the topa of the trees. Then to prevent static electricity in the turbulent air and dust from discharging upon and damaging the foliage vertical antennalike collectors are scattered through the grove to lead the electricity harmlessly to the ground THE INVENTIONS of a de

ceased inventor may be patented through appl cation by a legal representative of the Two morors one in a cab over engine act up the other just behind the cab power a truck proposed by Frederick A Ward of Highland Park Mich. The forward engine is connected through a drive shaft to a differential behind it and thence by more shafting to the front wheels. The rear



engine transmits its power independently in conventional fashion to the rear axie Either engine or both may be used at the will of the driver The system is particular ly useful for pulling out of d tches and for driving through soft earth mud or snow CHANGING THE MATERIAL of which an item is made does not in itself constitute an in LEARNING TO SAIL A BOAT IN the safety of your own back yard is possible with a device developed by Seifert W Roua

seau, of Port Wash ington N Y The mast salls and tiller of a small boat are mounted in their regular way aboard a dum my huil which is made so that It will tip or heel in the wind The entire assembly can be revolved to port or starboard by means of a revers able motor on esated by the tiller Used in a wind

the device is said to duplicate exact ly the response of

a real boat to tilier and sail adjustments ALL INVENTIONS are referred to by the Patent Office as improvements ITS TUNING DIAL at the level of the eyes of (Continued on page 22)

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#### With the Inventors

(Continued from page 29)

an adult standing in front of it, a radio receiver recently patented by Donald V Marsh of Lexington Ill, boasts a number of other novel features Control knobs, for



example, are at wasst level for easy manipula tion On each side near the top, lights swing outward at the touch of a button, making the set serve also as a reading lamp Beneath each light, con cealed bookshelves mounted on hinges may be opened out from the cannet when destred. The inventor points out that the outfit

not only serves as a floor lamp but places the tuning controls above the reach of small A MODEL OF YOUR INVENTION IS rarely required with your patent application . . CONVENTIONAL AUTOMOBILE SPRINGS might well be eliminsted entirely by wheels that contain their own spring mechanism Such wheels using cylinders pistons, and puston rods as snokes have been perfected and patented by John Bartho, of New York City, and John T Ackerson, of Radburnfair

Lawp N J The inventors point out that

heretofore any springing action built into

wheels has tended to let power application

at the hub turn the hub faster than the rim

With the present design, however, they claim a positive drive is automatically provided by short plungers that engage the outer end of each piston rod as it passes through a part of its revolution. The plungers on arms connected to the driving hub. extend and retract as one end slides along (Continued on page 24)



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#### With the Inventors

(Continued from page 22)

a ringlike track, engaging the piston-rod spokes to transmit power .. Extension or THE TERM of a U S patent can be obtained only by a special act of Congress MAKING SUBE THAT CARS, trucks, and



when a train is coming is the purpose of another automotive invention. An approaching train turns on a set of lights on a roadside post near the tracks. A brilliant fan of hight directed across the road strikes a photo-electric cell mounted on the side of any passing vehicle. The cell, through an electrical hook up, operates a valva which allows the vacuum in the car motor's intake manifold to release the car's clutch and au tomatically apply the brakes. Arthur W Cowles, of New Hampton, Iowa, is the m ventor of the system . . . A YOUNGSTER S SCOOTER THAT 'grows up" with its owner is the saventian recently credited to L. R. Johnson, of Cleveland, Okla, Built as a tri cycle, with one wheel and its pedals forward, and a pair

the device is suited to small children. Later, while a child is atill too small for a conven tional bicycle, the two rear wheels of the tricycle can be removed and one inserted on a short axle in the specially designed rear fork. A small be cycle is the result. just the right size for its owner, and ideal for teaching



a youngster the principles of balancing himself on a twowheel vehicle. The extra wheel can be attached to a broomstick and used as a pushing wheel, or it may be kept as a spare for replacement use



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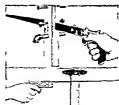
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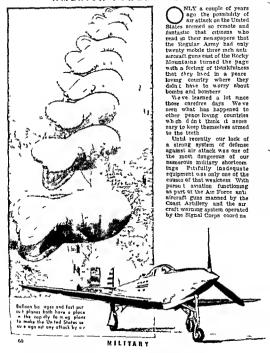
# The MAN

evolutions are nothing new to Major Edwin H Armstrong He has fathered into in the radio industry and today at fifty is watching his latest brain child F M stancless radio start a third As a motor cycle-riding sophomore at Columbia University in 1911 he polted radio out of its crystal detector-and earphone days with his revolutionary regenerative hook up Then while aevesdropping on weak German Army to

tions as a Signal Corps officer during World War I he thought out the modern one-dial superhet receiver Now after more than twenty five years of endless tinkering with F(requency) M(odulation) he has eliminated static-the Bugaboo of Broadcasting Experts once said it couldn't be done but this fall F M becomes a household reality and radio s \$4 000 000 000 industry feels another Arm strong revolution No swivel-chair scientist the soft spoken muld mannered major ex pects nothing of his assistants that be won t do himself even to dangling in a bosuns chair to rig antennas from the tip of the 400foot tower that tops his Alpine N J labora tory Major Armstrong hates to bave his picture taken dislikes personal publicity and won I have a conventional radio in his house

# ROMBERS

#### AMERICA FORGES NEW WEAPONS



# BEWARES

## FOR USE AGAINST AIR RAIDERS

tion was impossible Early this year a long forward stride was taken hy the organization of an Air Defense Command for the northeastern sec tion of the country Now for the first t me all the means and methods of air defense have been placed under the direction of a single officer-Brigad er General James E Chaney Although so far his Command has operated principally on an experi mental bass it is expected that the methods it has developed will be adopted as a much needed nation wide air defense system

In air defense as in almost every other operation of present day war fare time is the determining factor Bomhers fly about 250 m les an hour and pursuit aviat on must have warn ing of the r approach in time to get off the ground and into position to intercept them before they reach

their objective

Of course the defense can save time by keeping its planes in the air instead of on the ground but because only a small part of a patrol force can be in the air at any given time and hecause the average of visibility from an airplane is only about five





To have the best operate chance of doing their job of shooting down or driving away the attackers before they reach the bomb release I ne -wh ch for fast bombers flying at be tween 15 000 and 20 000 feet is about two miles short of the target-

the fighters must have about ten muntes of combat time That means that they must fly out at least forty miles to meet the attack and that they should be warned of the approach of hostile planes while they are at least 100 miles away

CEVERAL large scale tests have proved ) that an aircraft interception net com posed of volunteer civilian observers can be depended on to give timely warning of the approach of hostile airplanes to cities or other objectives located at least 109 miles from the seacoast or a land border With the cobperation of commercial telephone companies and the American Legion the Air Defense Command now is organizing such a net to cover the entire northeastern

portion of the country from Duluth Minn eastward to the Maine coast and as far south as Norfolk Va Observation postswhich are the observers homes-are six or eight miles apart and as from six to eight observers are needed for each post for twenty four hour duty several hundred thousand citizens will be signed up for this patriotic service

The operation of the system is simple When an observer sees or hears airplanes he picks up his telephone says Flash and gives his phone number. The central routes his call over trunk lines to the nearest Army information center A voice at the other end of the wire saya Armygo ahead Using a printed message form as a guide the observer then gives the direction and approximate distance of the planes from his post the exact time he saw or heard them and whatever information he can about their number, type, and attitude. As successive reports come into the information center the positions of the planes are plotted and from these plottings their course and speed are determined. This information, flashed to the officer commanding the defending nursuit aviation enables him to get his planes off the ground in time to meet the expected attack and then to keep his fivers informed by radio of the position of the attackers and the direction in which they are flying Tests have shown that the average time which clapses he tween the moment when an observer spots

a plane and the moment its position is plotted in the information center is less than three minutes

To aid in the defense of cities fortifications and vitally important in dustrial areas located close to our coasts or land borders the Signal Corps has developed an aircraft detector which is far in advance of any similar instrument used by any foreign power

fully developed its use may make possible deadly 'blind gunfire on unseen airplanes

One Signat Corps company equipped with his remarkable device now is attached to the Air Defense Command. As soon as the necessary detectors can be built, four mobile Aircraft. Warning Service companies each with supment for five or more mobile stations, will be organized for service with our field army, and if necessary, on our land borders. Six permanent warning stations are to be established on the Atlantic Coast, one on the Gulf Coast, and three on the Pacific Coast and an unbisclosed number in the Panama Canal Zone and in Alaska Hawai and Puerto Rico.

ETTING defending planes off the ground in good time unsulty means that the at tackers will suffer considerable loss and damage before they reach their objective but some of them are pretty certain to get through and they must be dealt with by the antiaurcraft artillery—the sky gunners who from the final protective line of air defense

No nation has and in all probability on nation ever will have, enough antiaircraft guns to provide this form of close in protection for all its cities and all its important military and industrial installations. Most of our sky guns are motorized and so can be moved from place to place

From observers reports the course of the raders is platted Orders to defense commanders get fast pursuit planes into the air to head them off

This new detector costs over \$50,000 and tad seign is as jealously guarded as the design of our secret airplane bomb sight But no secret is made of what it can do In this present stage of development it can under average conditions detect and accurately locate airplanes 100 miles away Undervery favorable conditions its range is close to 150 miles Nether clouds, fog, nor noise disturb its operation, and airplane augmes can't be shelded or protected against it Some officers predict that when it has been

hut it must be remembered that in a long day they can be moved about the distance that a homher can fly in an hour

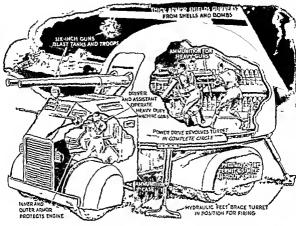
Antiaircraft artiliery is a highly technical arm of our (Continued on page 238)



SMASHING downward like a gigantic 300 000 pound hammer 150 tons of granite plunged fifty feet and crashed upon the roof of a bomboroof shell ter in a spectacular test make in Enginent The PA periment was conducted by government officials to determine the strength of a special granute concrete construction After the shelter had been built beneath the face of a quarry cliff drillers bored into the gramte near the top of the towering wall of stone Dynam te get off in the rock tore away 150 tons of the grante and sent it plunging down ward directly on top of the bombproof building below When the cloud of dust caused by this man made landslide had drifted aside officials rushed for ward to examine the effect. It was found that the structure was intact unharmed by the mass of rock piled high on its roof



Dynam to refeases a man made landal de abave a bombshe ter n a novel test As seen n the potu e at right the stuc ture rema ned ntact under the heavy lood



#### Mobile Pill-Box Fortress Mounts Two Six-Inch Guns

PILL BOXES on wheels, armed with twin six-inch guns in revolving turrets may prove a formidable new neapon for U S defense Racing to an unprotected area threatened with invasion, they would trans form it overnight into a fortified zone whose strong points could be shifted at will to meet the changing battle picture. The drawing above shows unofficially reported details of an experimental model built by a Los Angeles, Calif, truck manufacturer Subjected to four months of tests by Army engineers it is said to have attained a speed of sixty-five miles an hour

# How a gunner may aim his rifle around corners or over the top of a parapet with the new sight being demonstrated at the left.

Sharpshooters Fire from Cover with Periscope Rifle Sight

> SHARPSHOOTING acrobatics are made possible by a new Lshape periscope sight," designed to fit any standard military rifle Without exposing himself to enemy fire, an infantryman using the sight may look, aim his gun, and then fire st around a corner of a building, or over the top of a protecting parapet, without exposing himself to the fire of enemy sharpshooters The sight is



## Floating Fortress Lies in Ambush for Enemy Shipping FLOAT a forts in the form of low lying armored rafts at Genoa Towed to sea by

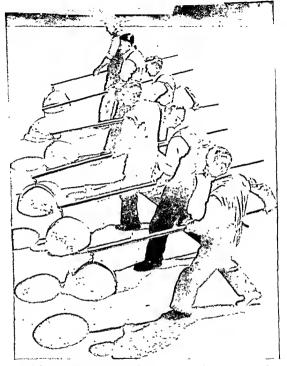
armored barges fitted with eight neb guns represent a new type of fighting craft in the Ital an Navy The photo shove snapped by an American seaman shows one of the ships such marine forts are left in strategic postions to prey on enemy ships which cannot sgot them until they are already with n range of their guns



ng a bomb w h lante Looding sidone at low tempe atues

#### Contact with the Air Sets Off New Powder for Incendiary Bombs

As the result of researches earried on m a laboratory m Melbourge Austral a Dr J R. Atcheriey has announced the perfect on of a new type of ncendrary powder for use in serial bombs The un que festure of his chemical com binat on he reports is that except at low temperatures the powder spontaneously bursts into flame as soon as it comes in contact with air This elim nates the necessity of using an elaborate fuse or other ign t ng mechanism As soon as the bomb strikes the earth and breaks its contents begin burning at a temperature of 3000 degrees C The new ly d scovered powder called Ign te has been tested before government experts in the laboratory and further experi ments are being carried on under actual bomb ug cond tions in which the trial missiles are dropped at proving grounds and the resulting damage is stud ed.

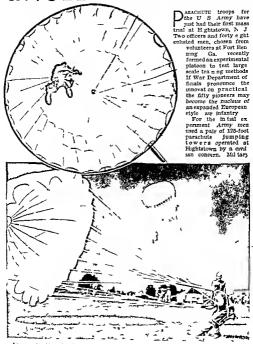


## **Odd Snuffers Smother Incendiary Bombs**

SNUFFERS for incendiary bombs are among the latest inventions for air-raid defense. Shaped like inverted bowls, and formed of asbestos sprayed over a wiremesh foundation, the snuffers are attached

to the ends of long poles by means of easily disengaged hooks. Dropped over blazing fragments, the absetos bowls are designed to snuff out the blazing chemicals and prevent the spread of the fire.

# UNCLE SAM DRILLS



Ame is an accordance of on the six of Hightstown N.J. This man is spilling the orfolm his chute after a leap from the 125 foot to a rig fower At top onether is being hosted to the top for 0 jump.

# PARACHUTE TROOPS

technique developed here gradually accus toms a novice to the feel of a real para chute drop in complete safety

A learner first drops in a permanently opened paractuite guided by wires as a musement parks Instead of sitting in a swing however he wears a standard har ness and is taught how to absorb the shock of landing on his feet

With the parachute still open but with out the guide wires the jumper next tries free drops. For this purpose the parachute

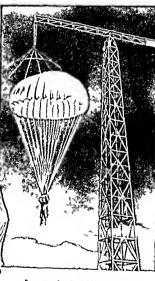
launching boom can be rotated according to wind direction so that he always will drift away from the tower. An instructor shows him how to spill the air from his chute as soon as he lands so as not to be dragged along the ground by a breeze

Finally the student bails out with a folded chute pull ing a rip cord to open it as he would do in actual warfare. If he delays overlong a safety cable brings him to a stop with out injury.

By these easy stages it is

proposed large bodies of U S Army in fantry could quickly be turned into ex perienced chutists Successful European tacture suggest that they would be dropped behind enemy lines to capture and hold key positions until reenforced by air or land

It is interesting to note that the United States Army was among the first to experiment with the use of parachute troops conducting tests at Brooks Field San Antonio Tex as reported in the February 1929 issue of POPULAR SCIENCE MONTHLY



Beg an ag a free drop with the chute open To keep the jumper fam being blown against the tower the boom is tuined with the wind At left a student has his harness adjusted

# What Are the Facts About

eng news proved by methematical and the means that the paradic banging and eracking of which we want that the paradic banging and eracking of which is your loudspecker could never really be eliminated. They were wrong. For the devel pement of a system of radia bradacist in known at FM frequency modulation) has not only conquered the static bugades but has given birth to other innovations that may well course a revulence in America § 40 000 000 000 radio industry. What are the facts about FM? This articled answers the question in Merica frequently acked



#### By E. W. MURTFELDT

- ◆ First of oil, just what is FM \* Frequency modulation, generally shortened to the initials FM, is a new type of radio communication that is static-free and almost unbelievably lifelike in tone
- What is the name for the present system of broadcasting? Amplitude modulation or AM
- ♦ Who developed FM? Major Edwin H Arm strong (see page 59)
- ◆ Arc FM programs being broadcast at the present time? Yes from a number of transmitters operating under experimental licenses most of them in the East and the Mid-West You may not be able to get FM programs in your locality at the present time but every month new FM stations are springing up in all parts of the country Broadcasting of FM programs on a compercial basis is scheduled to start early next year, according to present plans
- Con I hear FM programs on my present set?
   No To bear FM programs you must have a special FM receiver
- What was lengths does FM usef
   FM has been assigned a band in the ultra-high frequency range extending from 42 000 to 50 000 kilocycles
   That wave length is far below the regular broadcasting stations you hear at the bottom of your radio dial
- Will the introduction of FM make my present radio obsolete? No Your favorite programs will continue to be broadcast by the existing AM method for some time to come Your present set won the able to pick up the programs broadcast solely by FM transmitters but PfA's proponent expect that the major radio shows will soon be broadcast by both FM and AM simultaneously Foasibly both types of broadcasting will continue to exist side by side But if FM ever entirely replaces AM a good many years will have passed and you will be in the market for a new set anyway, as your present, receives will be obsolete.
- ◆ Do all the experts believe that FM is so superior that it sull eventually knock All completely out of the picture? No Some think that AM is plenty good enough as it is Others feel that improvements in AM methods could approximate FM is tone—and anyway, they argue, you don't need super-bigh fieldly to enjoy Amos 'n' Andy Because FM is range is comparatively small (fifty to 100 miles), many more stations will be required, and the problems of a coast-to-coast FM network are many But FM supporters see advantages in many of the points that FM opponents list as drawbacks.
- Are FM receivers on the market now? Yes
- How much do they cost? From about \$600 for the most elaborate type down to around fifty dollars



Frequency modulation was developed by Major E. H. Armstrong (page 59)



Even in the midst of a severe light ning storm programs broadcast by the new system are received distinctly



Man made static too is licked by FM You can use your electric razor and laten to the sadio at the same time



Because height gives wider range to FM signals there may be a scramble for mountain top station locations



Tests have shown that FM has great advantages in police work it also is likely to find wide use in aviation



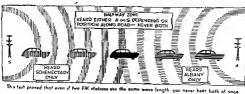
and in warfare especially for tanks and planes. The U.S. Army and Navy have been experimenting with it



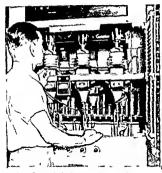
Amplitude madulation the common system of broadcasting will have some feen competition from its new rival

for a small set. This smaller unit can be blooked up to your present radio so that you can enjoy both And and FM programs from your present loudspeaker Most of the new FM acts will receive AM programs as well Most manufacturers expect the price to come down as FM set sales volume rises

- Don't you hear any states with PMf Well, General Electric effences recently placed a radio cabinet housing both an AM and an PM receiver in the laboratory where they create milition-void rathicial lightings storms. They turned the AM set to WABC, in New York CAI, and the FM act to WABC, Mayor Amach was rebreated that the PMF of the AM and the WABC programs by frequency modulation. With the man made lightings anapping only a few feet away they turned the AM act on and heard nothing but a bediam of static from the loudspeaker. Then they switched to the new FM receiver. The Programs came through with almost per feet clarity with nothing but a slight undertone of state butes, too dant to man the program.
- That sounds convincing, but suppose I tuned in an FM set during a real lightning storm. Would I hear the program clearly and without static? Yes
- Well, suppose I sat next to dan FM set and shaved such an electronic resor Vouldn't the man made statio caused by the vacor motor be reproduced in the loadspeaker? No And the same holds true for othburner motors duatherny machines vacuum cleaners, and all the other common exist makers.
- How about the tone of an FM radio! Is it really better than an AM set! Yes FM is astoundingly lifelike. Two comedians carrying on a dialogue sound as though they were hidden just behind your loud speaker grille. Symphony muso is no clear and brillant that you can practically pick out each instrument. For FM reproduces a far greater range of auchle frequencies than present methods. Extremely high and low tones that are now lost, are reproduced by FM with earl perfect idehtly.
- How about interference, equaling, and fading caused by two stations on the same or near by wave lengths? Does FM eliminate (Continued on page 237)



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A rectifier unit in the Armstrong experimental station at Alpine, N. J., seen with its 400-foot antenna tower in the large phetagraph Map below shows the proneer FM ex perimental broadcasting stations. More are being built

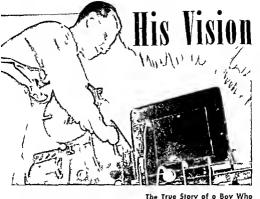




NOTEMBER, 1949

RADIO





HE only trouble with Philo T Farms worth a story is that it is out of time It helongs to another day It ought to he a hoary legend now and it s just twenty years old and still in the making It has everything the school teachers love

boyhood on a farm the dreamy inventor the years of struggle success It's the story of televis on and it all took place when folks whose names sip the mind for the moment dd a lot of shouting about the front ers he ng gone

Farnsworth dreamed of television with out moving parts when he was thirteen a year later still in h gh school he invented some of the bas c parts of electronic televi s on In 1927 when he was twenty he took out his first patent on an entire television system-not just one part-and Donald K. Lippincott the radio engineer called him one of the ten greatest mathematical wiz ards of the day

Today at thirty three Farnsworth is vice president and general director of research of the Farnsworth Television & Rad o Corp Such organizations as American Telephone & Telegraph Radio Corporation and Phileo have taken out ilcenses

under Farnsworth pat ents Foreign licensees include Baird Television Ltd. of England Fernseh

Warne laborate

Hod a Big Ideo and Followed It Through to Final Success By ELLIOTT ARNOLD



# Made Television

Aktjengesellchaft of Berlin and T C Reth ers of Australia

The story of Farnsworth a painfully shy man starts with his grandfather the first Philo Taylor Farnsworth who established the Mormon community of Beaver City in Utah under instructions of Brigham Young

Philos father settled a farm there and Philo grew up on it. When he was six he played con stantly not with wagons or tin soldiers but with a toy dynamo and a tiny electric motor One day he neged the dynamo to the wheel of his moth ers sewing machine generating enough elec tricity while she sewed to operate the motor His mother hoped he would let it stay that way for a while but the hoys interest was too feverish Hs took the motor apart and put it together egain

When he was twelve

wagon train to Rigby Idaho and worked a ranch in the Snake River Valley The place was the answer to a young inventor's pray er It was littered with equipment includ ing a private light and power system power operated hay hoists and harvesting devices that worked electrically

The mechanical and electrical gadgets were total mysteries to all except Philo who went for them with a wild shout of glee He took every thing apart and put it together again He arrogated to himself the sole right to keep the equipment in re pair and it was no contested position since no one else could do more than push the right button

smoothly it got to he no fun at all His family swears he de liberately put parts of lt out of commission when things got dull just so he could take them apart and fix it, His folks had been hoping maybe be would he an artist and optimistically had

He bad the equip

ment working so

been feeding him violin lessons He turned out to be a pretty good player hut it

never became more than a relaxation. He is a good violin player today and is an ex pert pianist

When his folks got wise to the planned vandalism of the machinery on the farm they thought they would put an end to it They gate him a new chore to keep him out of mischief-operation of the gigantic fam ily washing machine But they didn't know their son Farnsworth became fed up with moving the handle back and forth and rigged up an electric motor winding the intricate colls of the armature himself and acon had a power operated machine. He was not yet thirteen





A new idea takes shape on paper Fornsworth was thisteen when he got the inspiration that has guided his work in television

Farnsworth a very modest man does not offer any of this information with the intention of trying to limin the early life of a geniue

The only significant thing in all this," he says is that it gave me a hackground at a very early age of the elements of electricity, and gave me an incentive to attudy electric physics and through the medium of popular magazines a knowledge that there was such a thing as television."

The hot read everything he could lay his hands on that dealt with felevision as it was heing planned then, and finally he asserted to all who would listen to him, that the research experts were barking up the wrong tree trying to develop a television system by mechanical means

The major experimenters were using mechanical whiring disks to scan the image Farnsworth declared that this would get them nowhere for the ample reason that the transmission of a statefactory image required scanning speeds greater than any whiring disk could reach and maintain

Electrons, he said moved with the speed of light itself, and they could do the job if properly harcessed and controlled That conception is the hasis of today's electronic television—television with no moving parts —and it emerged from the head of a boy who hadn't yet started to shave

"I had a theme for research which continued through the years as a guiding light." he says, 'or as a direction for research and development namely, the shimination of all moving parts from television equipment.

well established in 1921 when I was thirteen, so that the moment I discovered tools—out of textbooks I mean—which would enable television to be done without moving parts the invention series of all of the continuous and the continuous experies almost the rof fact, aimultaneous with the discovery that there was an electron and a photo-electric ef-

'In 1922 when I was a freshman in high school, I made my first hig inention in television and it consisted of a means of producing an electric counterpart of

an optical image. At that time it was a daydream, a daydream only I had no facilities for doing reversch. I had no money to buy equipment.

All I had was access to a very modent school labrary, and my sum total of equipment for forming any definite practical idea as to the problem of television consisted of a static generator in the high school physics laboratory, and an old Braun tube!

NE of his high-school teachers, Justin Tolman took a great interest in Faras-worth The teacher and pupil used to hold long conversations on the molecular theory of matter, the structure and nature of electrons, and Einsteins theory of relativity The teacher later said that young Farasworth's discussion of the theory was the clearest and most concise he had ever heard

One day after school Farnsworth started to draw on the blackhoard. He worked for hours, correcting erasing, and then he began to explain it to his teacher. It was his conception of an electronic television system.

The teacher atudied for a long time and then admitted it was beyond him. He gave the boy the most advanced textbooks on the subject he could think of, and told him to go on with his dreams

Soon after the Farosworth family moved to Provo, Utah, and young Farnsworth took some special courses in Brigham Young University In (Continued on page 236)



• When "Dang" penned this cartoon some months ago, America's great defense program was just beginning to roll. Today, industry lass gone to war. Our powerful industrial giant is slipping free of his shackles and the smoke of activity is pluming from the nation's tactories. To provide our readers with an authoritative background against which to project the news of the day, POPULAR SCIENCE MONTHIA presents on the following pages the first of a series of dramatic articles revealing just how industry is being mobilized to arm Uncle Sam's ast forces of defense for guarding our country against the danger of attack from any quarter.

# Industry Goes

# HOW AMERICA IS MOBILIZING THE

MERIUCAN industry is mobile ing its mean and machines to fill the high great and most important order at has ever received. Time togoto to work whisties that have been silent for years are bloom ga again. Now plants are being built Govarnment arsenals are work ing three it fits ax days a week. By next spring our manufacturing machine will have been shirted into high to turn out the aurplanes gums fighting ships and mum tunn, we must have to make us safe againgt.

any form of aggress on
It took Hitlenized Germany seven years
of peacet me total mobilization to get
ready for the current war Never in all
history bad there been anything that
qualed that awe inspiring national effort

It was a peacetime mobilization that missed no one Industry was controlled by the placing of must orders and the allotment of raw materials and the salar ee of its executives were limited by government regulation Labor which worked seventy hours a week was controlled by the outlawing of unions prohib tion against chang ing jobs without official approval and outright conscription Capital was con trolled by compulsory investment of profits in no interest government se curities or in unprofitable enterprises It was strictly an or else program Orders were backed up with threats of heavy fines economic ruln or for the really obdurate a concentration camp or even a firing squad Those seven years cost the German people their political and economic freedom and the equivalent of 40 000 000 000 American dollars but they gave the Nazis the most nightmarish war mak

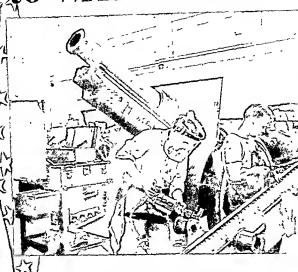
ing machine the world has ever seen In an effort to assure the safety of the United States in a world which gives every indication of remaining rough tough and dangerous for a good many years to come Congress in the course of its present session has Sppropriated over \$1000000000 in the form of cash and of contract authorize

frons for national defense Those appropriations will be spent to order 14 394 sirplanes for the Army Navy and so make a start on a progr which calls for the production of 2 planes a year by July 1942 to procure complete armament and equipment for a mo era highly mechanized army of 1 200,00 men and the hard to get in a hurry it armament and equipment for an addition 800 000 men to start the building! proximately 200 additional fighting shi which will give us a Navy powerful to control the Atlantic and the Pa the same time and to provide new no defense construction and manufacture facilities including the expansion of



Playing a march on a xylophone of you

# OWAR ARTHUR GRAHAME



parts and the building of thirty one ord frame plants far enough away from our goarts he beyond the range of air attack Congress has supplied the necessary all that Transforming those bilinous into forthers and fighters, into antiaireraft castless and feed guss, isto ships, tanks, mothly trucks, O D uniforms, Garand riged indershirts, and the 70,000 or so officer things the fighting services need is influstry to lig job

Hitler, using the dictatorial "entweder of "method of getting things done, actived astounding results by handing Getmany's industrial mobilization over of the rotund, hard-boiled, and able Marshal Hermann Goering and his economic

general staff of impressively uniformed officials Uncle Sam, stacking to our democratic Let's go, gang', method of voluntary cooperation, is condident of getting equally satisfactory results by having the production end of our preparentness program guided by industrial experts who work for the Government for nothing a year and who think, act, and look very much like the thousands of other doing-all-right Americians you can see any week day on New York's lower Broadway, Chicago's LaSalle Street, Detroit's Gadiliae Square, or at the Rotary Cittle luncheon in Springfield— Massachusetts or Illinois

To get those experts on the job, late in May President Roosevelt used the powers



When he made his appointments to the key positions on the National Defense Ad visory Commission President Roosevelt gave the world a convincing demonstration of the fact that the United States still is a country where the really big jobs go to men who have proved that they have what it takes to handle them

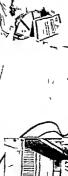
William S knudsen automobile assembly line wizard left his big job as president of General Motors to coordinate the produc tion of defense material break bottle necks and be the Commission's all around trouble shooter Edward S Stettimus Jr s gued his \$100 000 a year position as chair man of the board of the U S Steel to become the Commission s procurer of raw materials Sid pey Hillman who is in charge of coordinating labor and of training workers for the defense in dustries has been president of the Amalgamated Clothing Workers of America ever since the or ganization of that union in 1914

Ralph Budd the president of the Chicago Bur lington and Quincy Railroad in charge of coords nating all our transportation facilities Chester C Davis a member of the Federal Reserve Board who is responsible for accommodating agricul tural problems to the defense program Leon Henderson of the Securities and Exchange Commission in charge of the statistical study of prices and Miss Harriet Elhott, dean of women

The other members of the commission are



Apprentices of a Government arse nal where workers are being troined to meet the need far skilled man power Below a young mach n st with his diploma from a caurse at large factory



University of North Carolina, whose include the protection of consumers trying to keep down the cost of hving of the commissioners receive salaries, at the Government pays their expenses All them are assisted by staffs of executives d expert advisers

Thile the Commission has no formal exec-Ad authority it reports directly to the edident and under the National Defense the President has all the authority he eed to drive through the defense proauthority to establish priorities for would give Government orders the gh way whether or not business men ited is and authority to place compulsory rough So the Advisory Commission has on field although it has worn and is likely continue to wear, velvet gloves over them to dellings with industry

delling of the question of priorities Sup e for example, that Greene & Browne ze in the toy business decide to bring new design kiddie car and place their for the machine tools necessary to manufacture it. A week or two later Black & Vaite sign a contract to make—let s say —anticink gun parts They must have speity designed machine tools to make them d they can't get those tools in a hurry ause Greene & Browne got their order Black & White go to the Advisory Amiksion with their troubles Antitank may being, in the present unhappy state of orld affairs considerably more essential the nation s welfare than kiddle cars, the nission could ask the President to paste profity label on Black & White's order, Geene & Browne would have to wait whistle for their tools But the Comssion doesn't do that Instead, one of its resentatives calls on Greene & Browne explains the situation Greene and



Assembling a Garand rifle at the U.S. Arsenal of Springfield Mass Production of this new infants weapon was speeded up by the defense program

Browne go into a huddle and, being patriotic citizens, come out of it with an offer to hold over their new kiddle car until next year so that Black & White can get those antitank. gun parts into production

The Commission calls that the preference, or voluntary priority, system of procurement, and up to date it has worked so well that there has been no need to enforce legal priorities in order to get results

> Budd, the Commission's transportation coordinator. deals with the railroads provides another example of the 'Let's go, gang' method of getting things done without fuss or bad feeling Noticing that on June 1 there were almost 164,000 box and open-top carsslightly over ten percent of the railroads' freight-carrying rolling stock-awaiting repairs and anticipating heavy

> > 81

The way in which Ralph

After reconditioning these 75-millimeter field gun barrels will be mounted on new high speed corriages

delense-innestry traffic this fall, he wrote far congrationaler to helpher? In the president of the Association of thereins and the supsident of the superior of the superior of the Sasaha, to do their fart of the delense job the lines skold-rettice the proportion of 'had orders to less than six percent by October 1. The October figures arent available yet but it a a dollars to-doughnuts bet that when they are released they will show that the number of cars needing repairs has been reduced below the requested figure

TS ability to make good use of the per-sonal approach is one of the Advisory Commission a biggest assets. The automobile manufacturer who gets a letter from it anking him to go into the making of airplane cannon knows that it didn't come from some War Department brass bat but from Big Bill Knudsen the fellow who knows all about assembly lines The union official who is asked to solve the labor problems of a shell-making plant knows that he isn t dealing with some office-holding theorist hut with Sid Hillman a veteral labor man Gaudy uniforms and high sounding titles may impress people in some countries but American husiness men liks to do husiness with men who wear the same sort of clothes they do and who speak their lan guage That a one of the reasons why, even if some day we should get into a big war our industrial effort will be guided by cis diana

One of the reasons for bringing Knudeen to Wajhungton was plat he is a famous breaker of production bottlenecks. The first bettleneck is attempted to break on his new job was in the machine tool industry. Machine tools are necessity for the transport of the production of the produc

The firms is the industry offered the Covernment 100 percent cooperation, individeously and through the National Stachme Tool Builders Association. They airready had cracked one of their own potential bottlenecks by starting to train workers both in their plants and in cooperation with vocational schools. Friedrites weren i necessity of the state was needed was to tell the tool make and was needed was to tell the tool make not with the cooperation of the state with the commissions and the Army Ordanace Departments experts in designing a maghine much a experts in designing a maghine

where touries the production of rife barrels and in the development of a simple sungle-purpose lathe which can, it necessary, be operated by a woman and which can be produced by others than expert machine-tool makers. The work of the toolmaking industry basat been spectacular, and some of it of necessity has been slow, but it has here highly effective

Many people have feared that a shortage of some critical raw material might seriously handicap our rearmament. That is possible, but the danger seems remote We have nearly all of the materials we need, and have them in quantities which are practically inexhaustible For some years Government agencies have been huilding up stock piles of materials which we can't produce and which we might have trouble in getting in an emergency Just how large those stock piles have grown no one outside the Government knows, but it is no secret that since Stettinius was appointed to the National Defense Advisory Commission's procurement job he and his staff have diaplayed very considerable ingenuity in adding to them

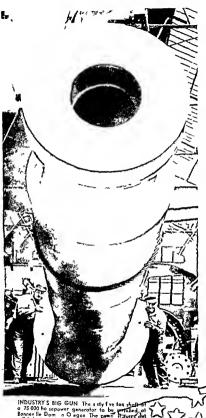
Most of our rubber comes from the Malay peninsula and the Fast Indies, and our supply might he cut off if Japan went on the warpath against us. That would have been fatal twenty years ago, but it is much less recommendation of the product of the comcase production of synthetic rubber made from petroleum.

Ordinary gasoline, the lifehlood of mechanized warfare, presents no problem. Our supply of 100 octane gas of which our expanded aff forces will use fremendous quantities is being conserved by means of an embargo, and adequate reserves are being stored in safe places.

The chemical industry is cooperating whole-heartedly in the national effort, even to the extent of its members exchanging closely guarded secret formulas with their competitors'

VERY bit as vital to our national defense as the man with the gun are the men bemund the man with the gun. The number of
workers necessary to arm and equip each soldier and keep him supplied with the food ammuntion clothing and all the other things
he needs in war bave increased in properties the needs in war bave increased in properties and the needs of the needs of the present of the present of the present war German military authorities estimated that they were going to need
eighteen workers for each soldier!

Rearmament is different from war be-



will help to make our count

NOVEMBER

credible loss and waste of war so we won't need so high a ratio of men in overalls to men in uniforms industrialists figure that during the coming year our defense program won't demand more than a tenth of our industrial productiveness

After investigating our probable manpower needs Sidney Hillman says that the reservoir of our 5 500 000 unemployed workers will take care of most of our labor problems of the near future Many these men are unskilled but many others of them uere skilled and the Gov ernment is giving them the opportunity to take refresher courses at WPA wages to bring back the skill they lost during their years of rust ing Large numbers of unemployed youths are being trained for the de fense trades The Gov ernment also is cooperat ing with employers in providing on the job train ing for employed workers who want to qualify for better jobs and in train ing apprentices The United States Employ ment Service which has over 1 500 offices will help in bringing the right worker and the right job together and in overcom ing labor shortages in in dividual trades and in par ticular localities

We have the money we have the materials we have the manufacturing facilities and we have the men What are we doing with them? Are we get ting anywhere with our rearmament job?

Pethaps our progress of increasing our art offer increasing our art offer increasing our art offer increasing our offer increasing our offer increasing offer increasing offer increasing our offer increasing our offer increasing our disappointing to the increasing our offer in the industry who men in the industry who

knew the trumendous amount of make meady work which would have to be come to uncrease production from a few bundred planes and engines a month to 50000 planes and 125 000 engines a year Most of the planes on order now are training planes—they are needed first Knudsen is confident that the industry in addition to filing its British contracts will be able to give us 18 000 Army and 7 000 Navy planes by July 1942. It will take a very production less of the creach has 50 000.

Most of the 10 340 large and small manu facturing plants—located in forty five states —which have been approved by the Army and Navy have received orders and are working on them

MERICAN industry is literally besting piou shares into swords Manufacturers of agricultural implements are producing guin carriages and combat wagons producers of lathes for making wooden shooting gallery ducks are turning out lathes for army appea church pipe organ makera supply wooden frameworks for military saddles Makers of printing presses are producing the recoil mechanisms for 155 millimeter howitzers manufacturers of vacuum cleaners are making gas maska and specialists in adding machines are turning out shell fuses Factories that formerly created toy zoldiers and miniature trains are develop ing gears and canteens troops in the field will sleep under mosquito netting furnished by firms that make lad es underwear

Weapons are rolling off the production lines in Government areenals and privately owned factories. The Springfield Arsenal is making 1590 Garand rifles a week two years ago its production was 150 a week. One manufacturing plant is turning out an average of six light tanks a day

Work has been started on a Govern ment owned Du Pont operated powder plant at Charleston I Ind Next spring it will start producing 20 000 pounds of powder a day In 1917 the contract for our first powder plant wasnt signed until after we had been at war for seven months A seamless tulung manufacturer in Pennsyl vanus is making steady deliveries on a \$25

000 000 airplane bomb order Within the next month or so the Quarter master Corps will take delivery of 5 000 000 and so fees will make 1 800 000 O D uniforms 4 000 000 yards of heavy woolen clold which will make 1 000 000 over me which will make 1 000 000 over me which will make 1 000 000 over me which will make almost 1 000 000 shirts for figitling men

Work is being rushed on the Navya com bat ships pow under construction. As soon as they are off the ways their places will be taken by other new fighters. The expansion of shipbunding facilities aton will be started to take cars of both naval and merchant shup construction.

From coast to coast the roar and clatter of machinery and black smoke belching from factory chimneys are telling the world that if any emergency arises America will not be caught unnercared!





#### Tests on Monkeys Give New Clew to Infantile Paralysis

BECAUSE infantile paralysis leaves a pattern of inflamed tissue along nerse tracts two scientists at Johns Hopkins University, Baltimore Md. Drs Howard A Howe and David Bulian have been able to prove that it can enter the body by several doorways Through experiments with monkeys they have shown that the infection can reach the spinal cord by either the mouth or the nose

## Insane Patients Helped by Electric Shock Treatment

FIGHTING insanity with electric shock is the most dramatic recent advance in the field of medicine At the New York State Psychiatric Institute in New York City. seemingly hopeless cases of the most common forms of insanity schizophrenia and dementia præcov, have heen shocked back to apparent mental health by the new treatment. Electrodes at the ends of a caliperlike instrument, are placed just in front of the ears on the patient's head From seventy to 100 volts of current pass through his brain. The result is a violent convulsion resembling an epileptic seizure

In some cases, a single electric shock achieves what seems to he a medical miracle, restoring the patient to sanity Previously, insulin, snake venom and metrazol, have been used to produce shock The electric treatment is painless leaves no after effects and costs less than shock producing drugs





Ready for an ascent Navy ac anauts take abourd a cage of p geom to carry reports back to the r base

ITH dive bombers and 400 mile an hour fighting planes in the head lines few people know that the drifting free halloon the earliest of all aids to serial warfare is still an essential link in America's defense program From the field at Lakehurst N J where the bal loon school of the U S Navy is entering its twentieth year silver hued gas bags have traveled a total of more than 25 000 miles in training flights Because a blimp with a disabled engine must be handled like

#### By ROBERT E. MARTIN

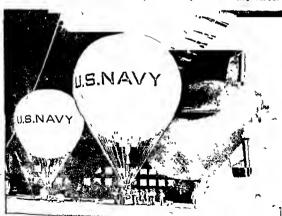
a free balloon, all men in the Navy's lighter-than-air service begin with a balloon course at the Lakehurst school

The six 35 000 cubic-foot balloons used in the work are inflated with helium. As one of them is filled for a flight, the ground crew adjusts the netting carefully so the fix-foot-square wicker basket is exactly centered. With as many as four students and an instructor squeezed into the basket, the ground crew "walks the balloon, towering seventy feet in the air, out onto the field from the hangar in which it was inflated Instruments road maps a woodsman so compass and carrier pigeons are loaded aboard. Then comes the start A show or of sand hallast, a slight upward push by the ground crew and the great gas bubble sours away. So sliently does it defit through the sky that men calling upward from the ground can be heard distinctly at an altitude of 1000 feet.

During the first five flighty the student watches and learns to Duech trip the performs some new task in connection with navignting the balloon. To rise he throws overhoard bailast to descend he lets out gas through a valve at the top of the bag. Throughout a alive at the top of the bag. Throughout a flight, there is a continual small secpace of gas so that ballast has to be discarded from time to time to keep affoot. To a balloon ballast is what fuel is to a plane.



The start Free balloons are directed by seeking levels where favoring winds blow



Inflated in the huge hanger at Lakehurst, N.J., these balloons are ready to be walked out by ground crews

when it is exhausted, the fight must end, Some years ago before hel um was used m Navy balloons Lieutenant Commander Samuel M. Bailey and two students from Lakehurst were riding under a hydrogen filled gas bag n p tch darkness over the Alleghenes For hours their balloon had been losing lift At one o clock in the morn ing Bailey dec ded to settle in landing The basket was four feet from the ground when high tension wires loomed directly ahead Bulging with thousands of cub c feet of explosive hydrogen the great bag struck the cables. At the same instant, both students leaped The balloon bounced back and then shot I ke a cannon ball toward the sky By hanging to the valve rope all the way up Baley stopped the zoom at 8 000 feet and descended unharmed on a mountainton farm Overnight fights are next to the last ones made by students at the Lakehurst school. As a special precaution the Navy sends a warning to all air line p lots to watch out for the balloons Two 1 ghts a steady white one and a flashing red one Eo ng down fo a a ding the boilet slip through are suspended under the baskets. Both are af nge of e befoe com ng to et n a feld battery run Because of the more even tem perature at n ght, two bags of ballast will often carry a balloon through the hours of



Fye's leap to he gound a the bag set e with p pane open At uppe ght a ew though the append's show gopen a e Righ the en cope nea y flot darkness On the other hand during one day trip Lieutenant Commander R P Tyler had to throw out five bags—150 pounds—of ballast from an altitude of 500 feet to keep from being carried to earth by a strong downdraft over a cool swamp a few miles from Lakehurst

Solo flights which end the train ing are never started if the breeze is blowing faster than fifteen miles an hour and all trips begin only when the winds blo v from an east erly direction carrying the balloons inland away from the near by At lantic With the wind as navigator carrying the gas bag in whichever direction it blows the Navy balloon riders are never sure where they will land One crean last year de scended in the middle of a cemetery another in brambles six feet high

Whenever possible the landing is made just beyon! woods so the trees form a windbreak Valving out gas the pilot brings the basket to within fitteen feet of the ground Then he jerks the ripcord tearing out a long panel in the side of the bag The gas rushes out the bag colispses and the flight is over

At the end of every overnight journey pigeons are released to earry back word of the landing lo cation and the bag and basket are shipped home by freight. During shorter daytime trips a truck fol lows the drifting balloon to piek up the equipment and crew.

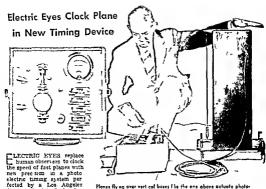
The simplest job these Navy, truckmen ever had came at the end of one training flight isst fall. The balloon took off in the morning and dritting west on a sea breeze disappeared over the field riding a what that blew in the opposite direction at a higher level and descended for a landing only a few hundred yas is from its starting point.



In flight oil tude s gained by dumping sond boilast in bags or fom pockets on the side of the baskel as above



After the landing in geons are released with responsing to head quoters. Then the bag is carefully rolled up and placed in the bashet At the left the balloan is loaded in the tuck which has followed its fight.



Planes flying over vert cal bases I be the one above actuate photoelect a ce s to start and stop the watch on the panel at the left

sky the 1 ght sens tive cells are placed at the start and finish of a carefully measured course As the speeding plane passes over the first box, it d me the light reaching the cell, which responds by starting a stop

Calif test pilot Inclosed in

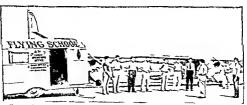
vertical boxes open to the

watch The second cell similarly actuated. stops the watch. By comparing the elapsed time with the length of the course the plane's speed as readily computed, A half mile suffices for the course and approach.

### Trailer Serves as Office for Airport Flying School

TRUNDLED out on Floyd Bennett Field New York a rolling airport office makes a convenient headquarters for Archie Baxter While he teaches a group of fight students

what to do with a plane Posted ins de the walls of the trailer his orders of the day inform his three assistants of the work cut out for them

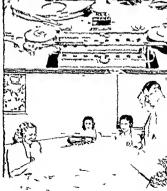


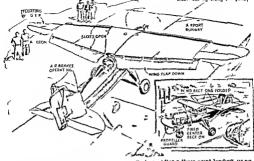
Flying students lined up in float of Archie Baxter's rolling office at Floyd Bennett Field. New York



through mouth or throat micro phones into a remarkable diclating machine for use during air plane test flights Pilots and en gineers at various statuons in a plane may thus record their observations simultaneously. Any one of the voice channels will also reg ister mechanical vibrations occurring at the individual pick up attaring at the individual pick up attaring at the individual pick up attaring at the individual pick up attasparartus plays back the recorded voices which are transcribed by of fice secretaries wearing earphones and stiting at typewriters

Through a standard sound record ing process voices and noses are imprinted magnetically upon a pair of moving their inbons each half a mile long and a quarter inch wide. The novelty of the new multiple recorder, devised by Herman B. Heller of Los Angeles Calif. hes particularly in its ability to make a suigle tape carry as many as eight unscrambled recordings.

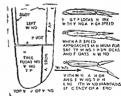




### Floating Wing Tips Give Added Safety to Light Plane

OP comb ning safety features of unusual variety in des gring a I ght monoplane for private flyers Emil Doebler of Buffalo N Y has won expert commendation Vert cal fleps of his own invent on flanking the rudder supplement standard wing flaps as air brakes Turned inward they belp to reduce landing speed-eliminating side slipping or fishtailing into a small fieldand also concentrate air flow upon the rudder so as to retain effective control Wing slots at leading and traffing edges assure needed lift by providing an even stream of air over the surface Allerons mounted on floating wing t ps which line up with the wind like weathervanes give full response at angles of attack large enough to make ordinary gilerons in

effective After a three point landing us ng a laid wheel the craft settles forward upon a trayele landing geer and wheel brakes brings it to a quick stop Hinged wings will swing back aga ast the fuselage to reduce the cost of retude hangar speen. In bad weather a pilot could make an emergency landing on a giveny fold the wings and drive away. But of the rod-barbary of the propeller (and the property of the continued of the production of the production of the property of the

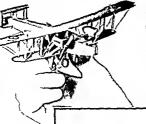




How ale ons an flaating wing tips give full effect with the wings at any ongle

Dawing at left shows haw plane lands an tal wheel toxs on its toycle gea

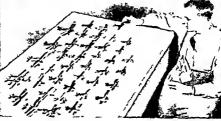
### Table-Top Armada Shows Famous World-War Planes



A TABLE TOP air feet of midget fighting planes representing most of the aircraft used in the first World War has been as sembled by Allan F Kitchel Jr of New York City All of the models have been constructed to the same scale one eighth of an inch to a foot. The first plane Kitchel built was a minanture reproduction of New Mooden bodies and wings carved with a jackkinte and razor baides while be fly mg wires were added with a needle and thread To bollow out the cockpits of the midget planes Kitchel used a heated nail

A Handley-Page bomber deting fom Wold Wer No I Land ing gear did net ret ect

Allan K tchel
poses bei de
his carefully
modeled col
lection of his



### Lie Detector Tests Emotional Make-Up of Air-Line Pilots

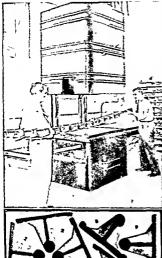
AVIATION



How a paspective plat sitested for wa ous emational reactions

TO DETERMINE the emo tional stability of pro-spective pilots American Airlines has begun mak ing tests with the lie de tector a del cate electrical apparatus developed for use in criminology After electrodes are strapped to the hand of the subject minute variations in body current are noted as the test placing the prospec tive pilot in various emo tion producing situations progresses A record of these variations in body current enables the oper ator to obtain a picture of the emotional make up of those applying for posi tions as pilots

### X-RAY MACHINE SPEEDS





Radiograph of small ampliane parts, each numbered for the record. Above, feeding a long structural member through the X-ray mach no

O DETECT invisible flaws in airplane fittings, Tom Triplett and Victor Barton have X-rayed 1 000 000 parts during the last five years, in the Lockheed plant at Burbank, Calif. This year, alone, they expect to equal or exceed that What makes the speed up possible is an automatic X ray machine they have developed, capable of exposing 114 sheets of fourteen-by seventeenmch negative every minute, A marvel of mechanical precision, it adapts assembly line technique to what has hitherto been a timeconsuming bottleneck in production. Ten of the devices, it is estimated, would make all necessary radiographs for America's goal

of 50 000 planes a year Standing ten feet high and four feet square, the big X-ray machine handles the largest airplane castings made. Open gates, on each side of its cabinet, permit making section-by-section "panoramas" of fabricated pieces up to two feet wide and thirty feet long Dozens of smaller parts may be X rayed at once. If stepped-up production of transports and bombers demands a higher tempo than is possible by hand feeding, a continuous conveyor belt will carry the parts to the

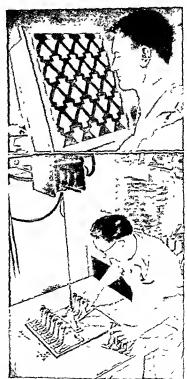
apparatus.
Shedded from the dangerous rays by 1500 pounds of
lead that sheathes the cabnet, the operator stands
alongsade the machine
Once he has preset its confront of the control of the control
of the control of the powerful A ray thee within
the cabinet burns out, if can be replaced in satyl

### UP PLANE PRODUCTION

seconds An electric lift raises and lowers the housing, and the tube pluga directly into its transformer, eliminating high voltage cables

As intently as a surgeon would study an X ray of his patient, experts examine the developed pictures of the castings in illuminated viewers designed especially for the purpose If a part is of uniform thickness, and contains no defect, it will give a shadowgraph perfectly even grayish time. Let there be such a flaw as an air pocket or a cavity caused by internal strains and the X ray "fingerprint promptly re veals it Since the rays pass through less thickness of metal at this point they give a stronger impression leaving a spot of different tint on the picture Even in views of castings of irregular thickness, where some parts naturally appear blacker than others, the engineer's trained eye instantly spots any telltale blemish in the X ray impression. Since every part is numbered for identification, any offending one may speedily be traced and discarded, saving lives that might be risked by its failure in flight.

For fittings that pass the test, the identification numbers enable a record to be made of the plane into which each one goes. Thus a continuous history may be kept of the performance of all "stress parts," the hidden but vital elements that bear the strain of banking, diving, and twisting in modern aerial combat. If one of them fails in action, its X ray record can be cherked and the spot where failure occurred can be studied for redesigning



Centering cost may to be photographed. In the upper picture on X-ray technician is hunting slaws in a negative showing forty-one parts

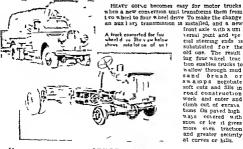




Test ag the life pleserve love cout plapased for B tsh fors Left coot n regula use

LIFE SATING overcoat, declared capable of keeping four men affoat, has been submitted to the British Admiralty by an English inventor Beneath its gabardine exterior the garment is hined with a ma terial six times as buoyant as cork In con sequence it is reported to weigh less than half as much as the present service great coat, while it is also many times warmer owing to its heat insulating qual ties. Thus the hie saving device not only conforms to government specifications for wearing apparel but also offers increased comfort, together with its service in a sea disaster

### Conversion Unit Gives Motor Trucks Four-Wheel Drive



front axle with a uni versal joint and spe cial steering ends is substituted for the old one. The result ing four wheel trac tion enables trucks to wallow through mud sand brush swamps negotiate soft cuts and fills in road construction work and enter and climb out of excava tions On paved high

covered with show or ice it gives

wavs.

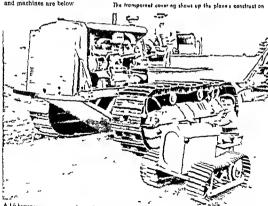
THIN sheets of cellophane held on with model airplane cement form the covering for a model plane built by Jack Schieder of Trenton N J Pe vealing the workmanship within the wings and fuselage the covering shrunk tight by a steam bath also provides an ideally smooth surface for the gas powered model Neat re pairs are quickly made on the

#### of transparent Scotch tape Boy's Midget Tractor Is Just Like His Dad's

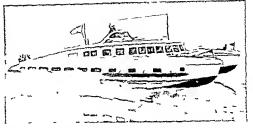
covering by patching on atrips

WHILF Marcus Ming Sr a Mississippi county road super intendent is towing heavy ma chinery with his huge track type tractor Marcus Jr is usually at home towing his playmates wagons here and there with his own 11 horse power working model of his dad s juggernaut Father son





A 1/2 horsepower gas engine drives the tiny tractor's treads through a troin of gears and separate clutches



#### Twin-Hulled Passenger Cruiser Hits 50 Miles an Hour HURTLING across the waters of the west- between Sochi and Sukhum in Soviet

HURTIA'S across the waters of the western shore of the Black Sea at fifty mines an hour the twin hulled streamine craft p ctured above carries passengers mail and express in a recently inaugurated service

Russ a Planing the entire distance on its novel W shape bottom the express cruser boasts a commod out cabin straddling the two hulls and open cockpits fore and aft

## Marke II Eur STEEL TURNS of used to carry write to frechistate cutting Special d rections; Special d rections of granished on a taj

The tog has mit uct ons for bending the new pipe

#### Division Marks on Steel Pipe Make It Easy To Measure

STELL TURNSO of the rigid conduit type used to carry write slose to machinery and fuse boxes or down the sides of houses from overhead lines is now available in ten foot lengths marked in inches and feet to facilitate cutting it into desired sections. Special d rections for bending the pipe are furnished on a tag which also carries a chart to show instantly the length of ppe taken up by each bend. The internor-of the pipe has novel raused and rounded knobs that make it canser to side wirse through

#### Gummed Rings for Notebooks Come in Handy New Form

GUNNED resufforcements or tabs for the holes in the pages of loose leaf noticeobes are now being furnished in stacks like doughauts on at the to facilitate attaching them. As shown in the illustration at the left renewal packages of the tabs come ready stacked for placing on the applica to a use the bottom tab is dampened and the part of the stack of the



### Robot Observer Radios Report on the Weather

NO WEATHER MAN need tend the compact observa tory pictured at the right for electric attachments in terpret the readings of its numerous instruments and an automatic radio trans mitter puts them on the air Receiving stations thus ob tain complete information on the air temperature haro relative metric pressure humidity speed and direction of wind and rainfall at the observation post Developed by Wilbur S Hinman Jr of the National Bureau of Standards the robot stations are especially suited for re mote or hard to reach loca tions where the maintenance of meteorological observers would entail physical hard ships or undue cost. A trial installation at Washington D C pictured at right, is reported to have given thor oughly satisfactory service in exacting tests Because of the simplicity of the mechan ism there is little about it that can get out of order



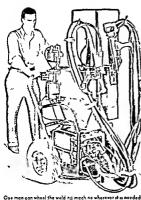
Automatic stations I to this report weather conditions by radia

### Ear Pads Protect Baseball Batters from Wild Pitches



pads protect the sides of the head when the player goes up to bat

EAR MUFFS for baseball players are urged by Ford Frick president of the Na tional League to guard hat ters against injury from pitched balls Made of ruh ber and leather the twin pads are joined like the ear pleces of a telephone headset and as easily slipped in place as shown in the illustrations at the left. Their generous pro portions afford nearly com plete protection for the head as the batter faces the plate while apertures permit per fect hearing Despite their effectiveness the lightweight guards are said to be no hindrance to the players



#### Two-in-One Welder Rolls Up to Its Job on Pneumatic-Tire Wheels

EQUIPPED with two welding guns a new shop outfit eliminates the need for duplicate equipment. Instead of requiring work to be brought to it, the unit rolls on pneumatic tire wheels to the lo cation of the job Necessary con nections for air water and power can instantly be made. A single transformer operates both weld ang guns and the transformer and gun jaws are water cooled.

### New Enamel Gouge

RECENTLY developed by en gmeers of the General Electric Company at Schenectady N Y a new electric gauge indicates differences as small as a ten thou sandth of an inch in the thickness of porcelsin enamel applications The gauges have proved particu larly useful in the manufacture of refrigeretors stoves and other ensinel ware

### Piano Keyboard Replaces Mallets for Playing Vibraharp

A PIANO keyboard takes the place of hand held mallets to play the vibrachord, latest addition to the xylophone family of musical instruments. Depressing each key

100

closes an electric switch and actuates an electromagnetic hammer that strikes a blow against the corresponding melal tone bar Separate switches control a vibratoresonating effect. The inventor

an orchestra leader created the novel instrument by remodeling a standard one for which he could find no player Now his wife a pranist, plays it in his band. Called a "v brackard" by its overtor the ost has a 2/1-octave keyboard that actuates magnet c hammers to str to the bars. Right folded for carry no

IRVENTIONS

### New Bottle Cooler Substitutes Cold Air for Ice Water

TO DISPENSE bottles free from dripping moisture a new electric powered beverage cooler substi tutes a blast of cold dry air for a tank of ice water Wire dividing racks within the refrigerated cabi net serve to segregate various brands of drinkables or to desig nate the warm bottles last added to the box Opening the top auto matically turns on a light that il luminates the entire compartment When in place the stainless steel sliding top may be used as a counter or serving stand



### Children's "Tummy Desk" Satisfies Their Yen To Sprawl

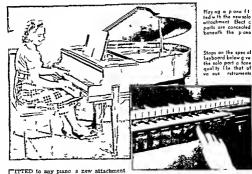
CATERING to children's quaint ideas of comfort a manufacturer has introduced a tummy desk for those who like to do their lessons on the floor It may also be used on a table top where its rubber feet pre vent it from marring the finish When short, detachable legs are made fast it be comes a useful bed desk for children or adults Beneath the binged top is ample storage space for books pads and pencils while a removable bracket at the back holds a large roll of scrap paper for scribbing





Two uses of the desk designed specially for children. With legs removed it may be placed on the floor as of the left. At the right, the short legs are attached and it becomes a desk for working in bed

### Electrical Attachment far Piana Plays Instrumental Sala



makes it sound as if two mus claps were playing an instrumental soloist and a piano accompanist. To render the melody one note at a time the player uses a bank or thirty six keys mounted beneath the regular fingerboard. Organlike stops give

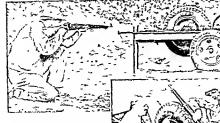
this sole part the tone of brass wood wind, or stringed finstruments at will. Meanwhile the performer fingers the accompaniment upon the usual keys. A knee lever controls the volume of the sole tones which are produced in vacuum tubes and made audible by a compact loudspeaker. With the at tachment at one end of the keyboard two persons can play a duet.



### Navel Hand Bending Taal Shapes Metal Accurately

The hard beed egical so use and some of the parts made with 1 A 12 sch rule gives 220 comparison and much asytting of material

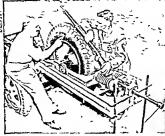
To AID in filling small orders of from fifty to 300 deplicate parts without the trouble and expense of making forming dies a Minneapolis Minn. mechanical products firm sought a universal hand forming ma chine Finding none on the market its craftsmen designed and high one of their own, When neighboring shops clamored to borrow or rent the original model, the Min neapolis concern decided to manufacture it. and now it has become one of their leading products A precis on bench or vise tool it bends round or square rods and tubes wire and strip stock to curved or irregular shapes with 1/1 000th-of an inch accuracy and much saving of material



### Bulletproof Tire Heals Own Wounds in Army Tests

FIRED point blank into the tread of a new military tire, bullets from army rifles and machine guns recently provided a spectacular demonstration of the ability of newly devised triple-layer inner tubes to seal themselves when punctured The tires, developed for use in the United States Army by laboratory workers in Akron, Ohio, are expected to prove valuable on gun carriages, antiaircraft gun mounts and machines of motorized cavalry Three layers of special rubber compounds, one of which is semiviscous, give the new tires their ability to 'swallow bullets without being

punctured The inner tubes formed of these



Examining a tire after rifle bullets had been fired into it as shown above in tests at the Aberdeen, Md., proving grounds

layers seal themselves without appreciable loss of pressure when they are piered by builtets. At the famous Aberdeen proving grounds, in Maryland, Army officers for 50 and 30 caliber builtets into the tree one time piered by 50 caliber machine, builtets, continued in service for 200 miles without additional inflation,

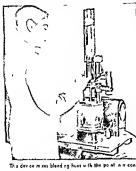
### Latex Injection Kit Repairs Leaks in Ball Bladders

With a compact repair kit just introduced by a Los Angeles concern, anyone can repair small leaks m beach balls, basketballs and footballs The kit consists of a tube of specially compounded liquid later and a hollow needle through which the fluid is forced into the interior of the bladder The latex is reported to seal a small puncture in a few seconds. The whole job of repairing a punctured bladder is said to be accomplished in about one minute As soon as the latex has had time to fill the hole, the ball is as good as new and can be pumped up and put into use again



A hollow needle is used to force latex into the bladder

### Paint Mixer for Stores Blends Colors To Suit Buyers



New Slot Machine

CLSTON MADE paint of any tint that a customer may fancy can be obtained from stores using an in genious new mlxing system. dealer need keep in stock only a few standard colors of base paint in These are supplemented by cartridgelike tubes containing blend ing hires Without removing the main hd of the special can the con tents of any cartridge may be in jected through a small auxiliary opening and an electric agitator thoroughly mixes the blend in two minutes time Thus a shopkeeper can offer a selection of several hun dred colors while keeping his store space and inventory to a minimum

#### Synthetic Glycerin

GLICERIA, commonly obtained as a by product of the soap industry can be produced in sufficient quan tities from petroleum to meet any wartime requirement according to chemists of the Shell Development Company

### Shows Sound Films

Sound - Movie cabinets operated by dropping a coin in a slot and quickly installed anywhere offer a new form of entertain ment for railroad stations lunch rooms and other public places Spensors of half a dozen makes aiready in use or nearly ready for production expect them to compete in popularity with the coin operated phonographs now in vogue A typical model is shown at right with James Roosevelt son of the President watching one of the reels his film company has made for it Using sixteen millimeter film it presents a three minute program the pic tures being projected on a small screen at the front One maker proposes a more ambitious sort of installation From a suitably located cabinet in a restaurant a system of mirrors would con vey the Images so that they could be viewed by occupants of every booth in the establishment.



elt vew ng p ctures on a new Talke



FILES of the Federal Bureau of Investigation contain 250,000 nicknames used by criminals They range from Carbolic Lid and Izzy the Eel to Slow Town Blackie' and "Boo Boo Hoo Hoo

ADDERS have an antidote for their own

DESERT TURTLES of the Southwest sometimes studiow enough water in a single drup to increase their weight forty percent



ICE CREAM factories in this country use more milk annually than 1,000 000 cous can produce

#### KING CRABS base blue blood

HORMONE SPRAYS now present apples from dropping from trees before they are tibe

CARBONATEO toft drinks were used in

RATTLESNAKE SKIN neckties are being sold in a Broadway store in New York City



CARRIER PIGEONS with a natural camou flage of mottled plumage are being bred for wartime use

SYNTHETIC RESIN made from vactus is a new product reported from Mexico

GASOLINE las an explosive power more than eighty times that of dynamite

RACE HORSES 11 the United States are not permitted to base more that fourteen let ters in their names



#### Kitchen Utensils Lend a Hand in Odd Music of Cowboy Band



Another alternately boxs and thwacks a bull fiddle constructed from a washiub a string and a broomstick By pulling against the stick he obtains a variety of more or less musical tones



Here: the full archestra. Elm noting the plana how many familiar articles do you recagnite in it?





Robert Howel begas a delcate peco of Baheman gas bowng by softening a tube of colored glass His wife holds a pine block to reflect head of gas fame

After drawing out the tuber at both ends for fac to e blowing the ait st makes a small bubble at one end



### Glass-Blowing

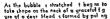
DUWING bubbles in glass has brought internat onal fame as well as a modest fortune to the Howell family of Union N J Touring the length and breadth of the United States in a housear contaming a complete glass working shop they have given thousands of demonstrat one before colleges schools and clubs of a del cate and beautiful art that dates from before the





By diawing out the white glass the ears and getters as gien the deled shape. Howell now adds the tiny plans to the holins by the use of the ewhite glass A log s attached in the same manne as the horns. Extreme heat caures the edof the body to mix with the white of leg-







To make the ears and antiers a rod of white glass s heated and touched to the sides of the head. Howell keeps on blowing to prevent the head if am collapsing

### WINS FAME IN ANCIENT ART

beguining of the Christian Era When they are not traveling the Howells work long hours over hot gas fires in the cellar of their New Jersey home creating vases animals burds flowers and other decorative knickbacks of glass to fill waiting orders from all over the world Robert Howell the father began his giass blowing career in his own home when he was in his teens blowing thermometer builts and laboratory equipment which sold to a chemical supply house Soon he wasengaged to demonstrate glass blowing to crowds at the Chicago World's Fair of



After add ng a to ! Howell exam nes the legs care fully to make su e that the f gu e w !! stand p oper ly The next step w!! be to pull off the long more



A frangle bent fom crystal rod s fused to the feet to serve is a base The completed figure is seen on the opporte page



C ocheted glass candela b o and sh p model made by M : Howell shown at work at the right Upperright es amples of Bahem an glass blowing done by the Howells

1893 When he married his wife also learned the art and the two went forth as a glass working team. Then came the children - two girls and two boys - and each of course became a glass blower During forty slx years of exhibition in cluding a spectscular en gagement at the 1939 New York World's Fair the Howells have instructed and fascinated literally millions of persons in the secrets of this ancient art

The Howells specialize in Bohemian glass blowing so called from the fame given it by the craftsmen of Bohemia It consists in shaping all sorts of delicate

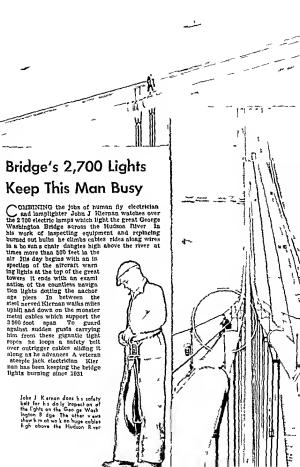
objects from thin glass with the use of only the simplest tools and without any kind of molds Original stock comprises glass tubes and rods of various sizes and many brilliant colors. One of the most expensive types of its glass is the beautiful ruby glass which owes its color to a salt of pure gold

Besides skill and a Keen artistic sense the chief requirement is a hot steady and sootless fire Howells fires come from specially built gas burners fed with air from a motor blower and capable of producing a temperature above 3 300 degrees ducing a temperature above 3 300 degrees the set is concept to by using reflecting blocks of white pine.



All blown work begins with a tube of glass of the desired color and size This is heated to the required softness—determined by the feel and color of the glass—and is counsed by blowing gently into it, and the color of the glass—and is Besuty and elaborateness of a piece are determined only by the skill and imagination of the worker

Crocheted glass is a special type of glass working that has been developed to a high degree of perfection by Miss. Howell Peccas of his work ranging from little glass baskets and candlesticks to elaborate candelabra and model sailing ships are built up loop by loop with yarn drawn from the end of a rod of crystal glass.



### Violins FROM SCRAP WOOD

Samuel Stachet making a piece of salvaged wood which will eventually become pait of a fine valin. A standard form is the postern

EAMS doors and shelves from old bouses supply Samuel Stochek New York violin maker with raw maternal for a fasce nating craft. His skilled workmanship transforms the seemingly worthless bits of lumber mto exquisite hand made violins valued at up to \$1500 apiece

As a buff follows are engues so Stochest trails wreckers demolishing outdated build ings Friends help keep han informed of fresh hunting grounds. His object is not primarily to save money for in these places he finds the hand of lumber he likes best. After fifty years or more of seasoning the wood is just right.

A lucky collecting trip to some half demol shed house may yield him a perfect slah of quarter cut flame grained maple which will make an ideal hack-the resonating part-for a fine violin. Other game includes spruce for the top or sound hoard. Armed with a knife and plane Stochek probes each likely looking piece to test the cut color and grain. If the wood is yellow on the outs de but white under neath it has not aged sufficiently Deep pene tration of the surface color indicates long sea soning Shavings of old wood crushed in the hand disintegrate into fine fragments newer wood is more cohesive Too fine a grain will make for undue loudness while grain that is too wide will detract from brilliancy of tone

too wide will detract from hrilliancy of tone

Back in his shop with his trophies Stochek
begins the task of shaping the pieces Delicate
gouging and planing constantly checked with



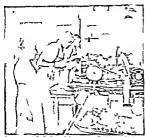
Search ag aid houses for good wood he tests I kely look ag pieces with a knife and plane

calipers thins a curved back until it is slightly transparent when held to a strong light. A single one of these pieces may take him a month to complete Other parts are assembled and after numerous coats of special varnishes and stains the violin is ready for use

Stochek himself plays the violin ably but he likes even better to make one It gives him a thrill to fashiou from a floor jost that has resounded to the steps of thousands of people a beautiful instrument that can sway the emotions of other thousands.



### WHERE HEALTH IS

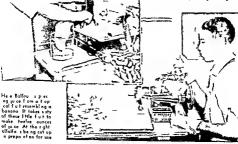


cene n AG Ba fou s labo atory at Englewood N J s e med c nal ju ces a s est acted f om st ange sou ces

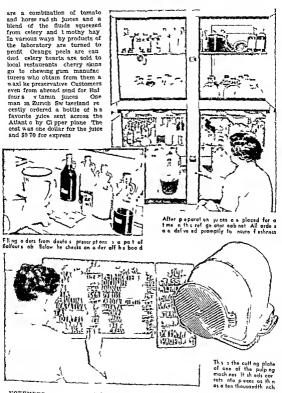
SIX OUNCES of grass juice Prescriptions such as that are all in the days work for Abraham G Balfour Fresh bottled grass juice which is sa d to vie with spinach as a source of calc um and vitamins is but one of more than "00 varieties of fru t and regetable juces and ther blends which he produces in his Englewood, N J laboratory His un que factory is running twenty four hours a day and shipments of choice garden and orchard prod ucts from as far away as Calı forma arrive at Englewood on a dady schedule

Balfours unusual business be gan five years ago A det cian en gaged in vitamin research he became interested in the poss b lities of obtaining concentrated vitamin fluids from various plants and fruits Spec al machines, such as a wh rling plate that cuts vegetable pulp into shreds one ten thou sandth of an meh thick, and a press which squeezes out nuce with a pressure of eighteen tons have been developed for the work. Among the most popular prod ucts of the Englewood laboratory

an add tion to grass banana wa tercress carrot, and spinach juices,



### PUT UP IN BOTTLES



### Locomotive Tires Reshaped Without Removing Wheels



Aw nehtowsthe locamotive bockword while cutting tools turn down its tres to reshape the worn spots

Oversize blocks replacing broke shoes hold the lathe type took

IOCOUTTVES no longer need be stroped of their driving wheels in a new time saving method for reshaping flat and worm spots. Instead, brake shoes are replaced by oversue hicks which hold lathe cutting tools against the metal time. A wunch their slowly lows the locomotive backward along the track by a strong cable whole the tools of the same than the story to the strong the strong cable while the tools with callying alone the progress made with callying show the progress made

Tried out successfully on heavy mountain locomotives the scheme is said to have greatly reduced the period during which an engine must be laid up for repairs Formerly



it took a week or ten days to dismanue the drivers remove the tires turn each one to size and roundness in a wheel lathe and restore the locomotive to service \lambda ow only a small fraction of this time is required at a great saving in cost as well.

### Factory "Sprinkler" System Uses Carbon Dioxide Gas

Laive carbon doxide gas instead of water a radically new sprinkler system automatically smothers fires in rooms where gasoline naphtha, oil, lacquer or enantel is handled Employes have only to rush to safety leaving the fire fighting job to sensitive heat detectors that open the gas valves in pioneer installations de signed by Waiter Kidde & Co of New York, nozzles may be located over small tanks or a whole room may be flooded with gas as doors and windows shut automatically



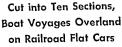
A "flosh f' e" storts in a factory room where inflammable I a u ds are handled. Note earlies

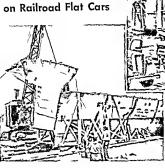


The wo kman leaves the room as heat automatically releases gos kept under pressure in cylindets



Ellowing from nowles carbon dioxide smothe's flames. Doors and windows class outsimpt cally





Sections of the Mount Wash anglon 11 on flat cars for ship ping. The vessel is being put tagether again in view at left

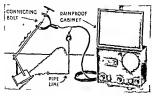
It is believed the largest ship ever transported in this novel manner Weided together after its arrival the all steel vessel was expected to prove even stronger than when it first was built. The unusual transfer was

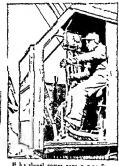
made to replace another boat for tourists which was destroyed by fire last winter Accompanying photographs show how sections of the Mount Washington II were carried on flat cars and reassembled

SLICED neatly into ten pieces the 205 foot excursion steamer Mount Mashing fon II recently traveled 300 miles by rail from Burlington \t on Lake Champlain to Lakeport N H on Lake Winnepesaukee

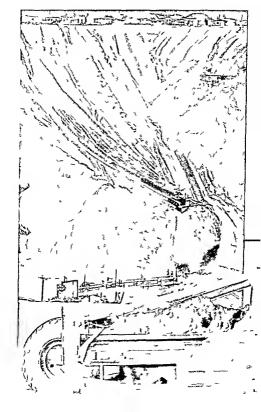
#### "Pipe Finder" Gives Warning as Power Shovel Nears Line

WEMING headphones a power shovel opera for now can excavate right up to a burled pipe or electric cable without damaging it for a warning burz tells him when to stop Resem bling a radio set, the pipe finder is connected to the excavator's frame a battery and any tisble part of the conduit. A control dial compensates for the difference in electrical resist ance of dry wet and rocky soils





If his shovel comes near a pipe The the aperator hears a bust. Illustration at left shows panel and how it operates



### Moving the Earth

### MECHANICAL MONSTERS HELP BUILD DAMS

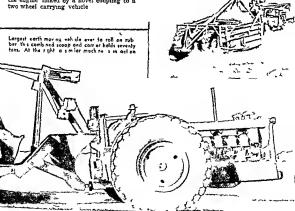
P A twisting canyon leading to the crest of California a two mile long Hansen Dam a strange snakelike vehicle rolling on grant tires taller than a man eased to a stop the other day and dumped more than thirty three tons of must desired sand and siit. The spreading of that load marked the princiacal completion of the large est earth fill structure ever built and ended the first practical test of several ingenous earth moving machines designed to pick up loads that would tax the capacity of railroad freight cars and carry them at speeds of thirty niles an hour across rough ground.

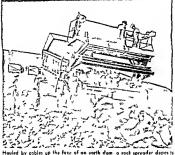
Month by month the men who turn out these mechanical monsters for moving earth surpass their own amazing records Until recently self loading excapes roled on four wheels and were towed by tractors. Then R G Le Tourneau a wide awake mid western manufacturer conceived the idea of combining tractor and trailer indeed for the self-western and trailer in the Tourna pull a balanced two wheel unit mounting the engine linked by a novel coupling to a two wheel carrying vehicle.

Through a system of cables the operator raises the nose depressing the center and causing the scraper to bite into the earth When its loaded the front gate is closed Raising the center the driver then roars away at a half mile a minute speed.

The first of these odd cargo carriers mounted thirty four ply thres weighing 1500 pounds and hauled forty five tons of loose dirt and gravel—more than a box car can handle Recently Le Tourneau completed a new giant one riding nue foot trees. These machines are capable of taking into their powerful steel gives aeventy tons of materials or almost enough to fill two rail way box cars. Soon a 150 ton model capable

### By ANDREW R. BOONE





stone n as even sheet or the lood pours out the rear gole over rolle's of carrying more dirt than eighty small an electric crane

trucks will be available
No ther springs nor steering wheels have
been built into these odd machines. Their
high power Desel engines project in front
of the wheels like large trunks. To turn
the operator slips a cone clutch and applies
a brake on one wheel. Engine power de
livered to the opposite wheel swings the
invered to the opposite wheel swings the

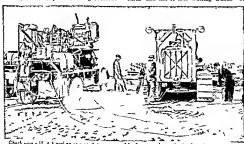
unit in less than its own length
Walk around any of these bg construc

tion jobs and youll see these tractor drawn trailers bouncing twenty five miles an hour across ploughed fields with tons of loose drt piled hgh. Whereas trucks must stuck to prepared roads these habies can go almost anywhere

Formerly rock was spread over the slopes of dams from trucks lowered by cables En gipeers were unable to smear the beavy cover ing to a un form thick ness however so a spreader which distrib utes the rock evenly and to any desired depth was developed. Resembling a large dump truck body the machine is filled by trucks Held in check by cables running to

an electric crane the skip rolls by gravity to the dumping area. There half the load at des out on rollers as the machins moves slowly uph II. Next the front of the hody is elevated and the remainder of the load is scattered.

The big machines must be kept going day and night to guarantee profits on contracts running into the millions. Formerly long drag I nes would pull in scoops of earth and lift it into waiting trucks. To



Check your al? At aveling seivice station manned by face men keeps the trucks and tractors ralling



to a bud, and an endless belt raises a continuous stream of the tiny particles dropping them into the rolling buns By this means, earth is stored at the foot of the conveyor, moving upward when

the operator presses a switch to fill a truck. To keep these valuable machines on the move with a minimum of costly break-downs and repairs, a traveling service station made its appearance at Hansen Dam not long ago Four men operate the unit In file minutes after swinging into action alongande a tractor or truck, they can fill up the fuel-oil tank check and fill all tires, completely lubricate the mechanism with compressed-air grease guns, repleinsh the gasoline supply for the starting engine, and fill the raduator. On hig jobs these trucks move from vehicle to vehicle, to keep the

How are flats repaired? It takes three men, pulling at a six foot wrench, to remove a 2643 pound the from the axle of trailer or scoop When the casing falls off, it must be picked up by a crain No less than two pairs of hands can pull out the

wheels turning without delay

143-pound unter tube from the gant abor.
After the heavy tube has been repaired,
it again is inserted in the casing, a protecting flap weighing fifty-one pounds shoved
into place, and the trie lowered in a civil
sling onto the wide rim. The tire, held in
place by two rings, then is inflated to a
pressure of fifty pounds, and lifted against
the axle.

Ready to roll, these tires stand 1048 inches high are nearly three feet week, and will carry 41,200 pounds each through dart and gravel at a speed of twenty-five miles an hour Although they cost \$4,285 apiece, including a \$375 tube, you can scarcely compare their mileage with the tires an your car, for they seldom roll along a paved highway Regardless of cost, however, men must move earth on rubber, for these tires supply the only springs on their bridgelike vehicles and make possible highway speeds over broken ground



### Round the

AKING pictures of places he has never visited provides an unusual hobby for Ernest E Draper, of Scarsdale, N Y Work ing all day as a commercial photographer, and teaching at night in the School of Modern Photography, he has no time to spare in visiting scenic spots of the world. So be does the next best thing, and reproduces them in miniature in his cellar workshop His camera clicks, and he has a photograph simulating a Dutch windmill a street scene in Algiers, a Rocky Mountain landscape, or a diver opening a treasure chest on the floor of the sea Hung in salons, his views have been praised by critics, and show such realism that many a visitor insists he has stood

at the very spot portrayed!
Only the simplest of materials,

MOUNTAIN SNOW SCENE You may think you have seen the very spot shawn in the phata above but you haven?. It is a synthetic set ting built up by Ernest E Draper, table top cameramen from the simple materials below



A reflector with a lacust twig stuck an it for a tree trunk farms the faundation of a hill which is covered with cotton snow as seen below For follage a sprig of arbor vitce is pinned to the tree and mare of the same material is scattered about in the snow to represent bushes





### World on a Table Top

available to any cam era fan who would like to try his hand at the novel pastime are used by Draper to obtain his striking effects cause of the enormous ly reduced scale of the table top scenes vari ous mosses serve well for grass locust twigs for tree trunks and delicate sprigs of cedar for foliage Cotton sprinkled with ground asbestos and salt makes convicting spen Cardboard forms build Modeling clay useful for human fig ures and various ob jects also comes in handy for sticking trees and other features in place

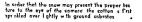
For a background Draper projects a lan tern slide upon a back drop of tracing paper Either a standard pro jector or a photograph ic enlarger may he used Backgrounds

may also be drawn painted built up or enlarged from actual photographs. A single 100 watt build in a simple reflector illumin ates the foreground opposite it a sheet of cardboard acts as a reflector to lighten the dense shadows that it casts.

finished setting
The bactgraund is
a genu ne mountain
photog oph projected on a tracing
paper screen by an
enlarging camera
Note the lighting

Photog aph ng the

a after which the whole scene is coaled with soft from a flour siter. Above Droper sticks cut out bids on glass just back of the free









Note how the adjustable sociat centers the bulb in the reflecta Right extended to blood beam

### Cotton Holds Tints in Color Kit

COTTON EATHING impregnated with colors for tuning photographs is now supphied in kits for the amateur After a bit of cotton is wound about the end of a pointed stick it is disposed in water and the tint is applied to the photograph. According to the manufacture the eclors can be applied to praist of any type surface if incorrectly applied the funs can be rankelated with a chemical solution



Color impregnated cotton is wound on a stick and mo stened



beam The nearer the hulb is to the reflector the narrower the beam. Like a convertible lens permitting both wide angle or telephoto shots the new reflector enables the user to ad

just his lighting to dif

ferent conditions and

for various effects

#### Spring Clamps and Rods Anchor Tripod Legs

To referent tripods from supping when set up on tile or
smooth inoleum floors a simple
spring-clamp attachment has
heen marketed by an American
manufacturer The clamps while
can be adjusted to any position
on the legs of the tripod anchor
a trio of horizontal metal rods
which prevent the legs from
spreading on shippery surfaces

### FOR CAMERA FANS



### Chemical Outfit Tones Prints Without Need of Bleaching

PRIVES can be given a blue brown red or green tone in a single operat on by means of a new toning outfit which eliminates the necessity of heaching the photographs. After the print is developed in chemicals that come with the kit it is placed in the toning solution until the desired depth of color has been atta red.

#### Photo Album for Enlargements Uses Loose-Leaf Binding

An albem without pages is a new aid to grow the service enlargements. Between covers of transparent plaste material a ring bind ing holds narrow strips coated with adhe sive and protected by a transparent cover ing. To attach an enlargement to the strip the covering is removed.



Enta gements are comented to loose leaf st ps

### Novel Swing-and-Tilt Lens Mount Corrects Distortion

DISTORTION in snapshots taken at in angle on he corrected during en largement by a new swing and tilt lens mount used in connection with a tilting ease! Objects in the picture can he lengthened or shortened by swinging and tilting the lens According to the maker the entire picture can be focused sharply on the tilted easel without stopping down the lens

This enlayer lens mount is used with a titing easel as at right



### Movie "Tripod" Stands on One Leg

Movie Tr

FINISHED in black lacquer and polished alumnum, a telescoping metal leg provides a steadying support for home-movie cameras. The fifteen-ounce accessory can be supported by a neck strap or on the ground.

### Darkroom Trays Identified by Bright-Yellow Corners

YELLOW corners on rubber coated darkroom trays show the amateur at a glance which tray holds a given solution, and let him use the same trays for the same solutions each time The trays have one, two, three, or four yellow corners



The number of yellow corners on each tray labels it

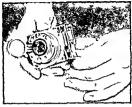
### Tyro's Kit Holds Everything from Camera to Enlarger

EVENTHING from a camera to an enlarger comes in an nexpensive beginner a kit recently marketed. The outfit contains, in addition to a fixed focus camera and a midget enlarger, a reel type developing tank, a darkroom thermometer and strring rod three plastic developing trays, clips, film, chemicals pinnting paper, and a darkroom safe light. The kit enables the tyro to cover all phases of photography

Falded the support rests an a neck strap and fully estended it is set an the ground to steady a camera



Using the enlarger and easel that come with the outfit shown with all its accessories—including a camero—in the photo at the left

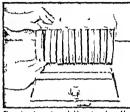


### Many Built-In Accessories Feature Midget Camera

LITTLE larger than a pack of cigarettes a precision camera built by Swiss watch makers and recently introduced in this country provides a surprising variety of features Four built in filters are selected by a small knoh There is a built in exposure meter a built in sunshade a self-timer and devices for taking strobosopic plctures panoramas and pictures at right angles The camera s midget tripod is no larger than a fountain pen and has a handy vest pocket city and such such persons a superior than a fountain pen and has a handy vest pocket city and such such persons and pressed and such persons a superior and such persons and persons a

### Lever Ejects Movie Reels from Handy Container

PRESS a lever and out pops the reel of home mortle fim you desire from a new metal storage cabinet holding a dozen eight or sixteen millimeter reels. When the cabi net is opened the side swings down re vealing a strip beneath the film cans on which is written the contents of the various reels. Pressing the liver above the desired reel ejects the can holding the



The automatic conto ner holds up to a dozen films

#### Folding Darkroom Is Easily Stored When Not in Use

WEIGHING only forty five pounds a light proof dustproof col lapsible darkroom is now available for apartment dwellers and those hving in homes where a permanent darkroom is impossible Assembled it provides a working space 7 long 614' high and 314' Wide It can be knocked down in a few mo ments and when folded forms a compact unit only 46" by 2612" by 814" The folding dark room is constructed of special double faced box board.

> ideal for apartment dwellers this roomy folding da kroam requies little storage space



# C pped to the edge of a t ay

the momete sout of the way

#### Tiny Thermometer Clipped to Tray

CLIPPING to the edge of a photograph c tray a m dget out of the way thermometer gives a constant check on the temperature of chemical solutions used in the develop ment of negatives prints and enlargements The black expanding fluid in the ther mometer is said to be easily seen under aafelights

### Phonograph-Disk Shutter Checker

BY PLACE G a specially marked paper disk on a phonograph turntable and photographing it with the turntable revolving the amateur can test the speed of his between the-lens shutter The d stance a dot on the circumference of the disk moves during the time the shutter

is open varies according to the length of the exposure



developed film as projected on the diskle back to get shutter speed



In this outfit the color filter is a the bax with the light

#### Apparatus Simplifies Color Separation

REVERSING the usual procedure for making color separation negatives from color transparen cies a new darkroom appliance is said to produce improved re sults Ord narrly the transpar ency is placed in an enlarger and the image projected three times on panchromatic film with a different colored gelatine filter placed between the transparency and the film each time. The new method employs a special metal box containing a lamp that illuml gates the transparency from be hind with the gelatine filter in serted between the light and the transparency A camera holding panchromatic film is focused on the illuminated transparency to record the separation negatives. The new procedure is said to prevent fogging of the film.

### Un-Natural History Gus Mager

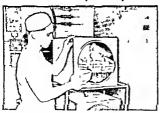


0 V EMBER 1940 127



Applying the new floor finish. If dies within Swenty tour hours

### Cheese Flavored by Hickory Smoke



Cheese cames out of the smake house' Hickory & ndling is used

CHEEST, like that's hams now is being flavored with hickory winded in the process developed by experimenters at lows State College two metal chambers constitute the "smoke house" in the first, hickory kndling burns to provide the smoke which is piped to a second chamber above it Here it comes in contact with small rectangular pieces of cheese wrapped in parchament. The wrapping keeps the cheese clean, while letting the flavor penetrate

#### "Concrete" Finish for Wooden Floors Put On with Brush

RESEMBLING concrete but applied with a roofing or whitewash brush as illus trated at the left paint' prevents old wooden floors from splintering Concrete floors with a tendency to dust may also be treated successfully Because of its extreme durability, the finish is recommended for places subjected to heavy foot traffic. such as steps, and porch flooring Two coats give a glossy enamel surface The finish dries in twenty four hours, and may be obtained in four tints -- green, red, brown, and gray

#### Phone-Book Hangers Keep Table Clear

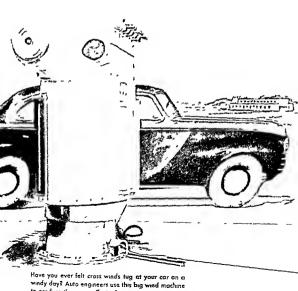
A CONVENIENT new set of hangers for directories, attached to the side of a home telephone table keeps the top cleer for consulting a shopping list or joiting down memorande Holders made of synthetic plastic, in different colors, distinguish one phone book from another



Calored hangers hold directories

# **AUTOS**

Visit the Auto Show with Gus & Joe HOW YOUR 1941 CAR WAS TESTED Drivers Wilbur Shaw Won't Ride With



to produce the same effect when test no new models

Aner model to the both the bound of Sens of Se

In the Loboratory and on the Proving Ground, the New Models Are Put Through Grueling Trials

> How much pedal pressu e does t tale to apply brakes at var ous speeds? Treat runs with the reco d ng dev ce tell the story

ECAUSE engineers mounted toy size automobiles upside down in a wind tunnel, your 1941 car will give you more mileage to the gallon than your last one It holds the road better when a gust of wind strikes it, for test drivers have sped cars like it past the fifty-mile-an-hour blast of a giant propeller. Its greater stamina and resistance to wear are consequences of such bizarre experiments as giving gears an artificial fever in a radio furnace

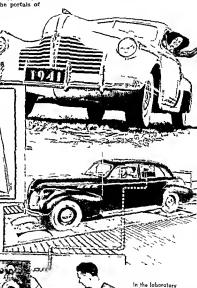
The fact that the new cars excel the 1940 model; isn t any happen-so. It a the frevitable result of unceasing research and constant trial at the great engineering laboratories and proving grounds where new automobiles are born. Within the portals of

these fascinating places is to be found the story behind the new cars behind the show windows

Five thousand parts not counting nuts and bolts go into a typical

The 1941 Buick is a product of countless tests and experiments

1941 car To design them, and select the best materials available, research specialista employ tools that would be the pride of any leading scentific institution A glant spectroscope reveals which of the fifty-two metallic elements are present in an alloy under test, by tellfale lines visible in a rambow of colors, while ultra-violet and infrared photography defect other dentifying lines invisible to the human eye Transparent plastic models of alto parts, examined under polarized or "one way light, show just where stresses are concentrated and make it possible to eliminate uscless metal elsewhere Employing a cathode-ray tube

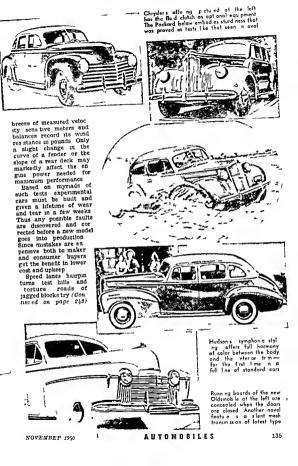


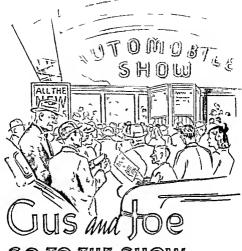
Torpedo type design gives the new Nosh o wider windshield and room for four in the front

While a cor runs on rollers on a roof as at the right a microphone picks up body noises

> below engineers listen in while an instrument records any sign of a squeak or rattle







## GO TO THE SHOW

"DY GUM you're all starry eyed Joe Clark sad to his Model Garage partner Gus Wilson as they started up the broad stairway of Grand Central Palace
Stre. I em. Gus. adm.tted. without.

shame This New York Automobile Show always gives me a thrill and Yee been coming to it for a fock of years I remem ber my first show as pilainly as if it had been yesterday—and it must have been thirty five years ago They held it in thirty to years ago They held it in thirty to year ago They held it in old Garden Cad liacs and Oldsmobiles and White Steamers and Autocars—those ald timers look funny when they day them out now but they were hot stiff then But it.

was an exhibit up in the balcony that inter ested me most-a racing car called the 999 There was a thin faced quiet spoken sort of fellow standing by it in the booth and somebow we got to talking He told me that his name was Henry Ford and that he had built the car and driven it at better than sixty miles an hour on the ice out near De tro t. That was a thrill-talking to a fellow who had driven a mile a minute But I got a bigger thrill when I got back on the mam floor and a girl came along all dressed up to kill and happened to give me a look out of the darndest green eyes I d ever seenand that goes for now too It sort of took my breath away and no wonder-I heard a fellow behind me say That was Anna

Held who just passed us Now Joe don't tell me you don't know who Anna Held was

Yes I know who Anna Held was Joo assured him. She was long before my time but I saw a movie all about her a few years ago. It was one of those historical movies he added unknuly. I suppose it was the remembrance of that one look she gave you with her green eyes back around 1905 that kept you from ever getting married.

Well I wouldn't go quite that far Gus told him But I was young then-

Sure—you were young then Joe par roted And now whenever you get close to a few new style gas buggies you go downight childish. I'll bet a quarter you it come out of here talking about buying your self a new car Well I won t--mine a good for another two or three years

Gus grinned wisely as he handed over the r tickets and they started into the hig exhibition hall Lets start hy having a look—he began and was interrupted hy a

feminine vo ce

Yoo hoo Yoo hoo Oh Mr Wilson He looked in the direction of the hail and saw the talkative Mrs Miller and her husband Henry

Oh my gosh Gus muttered Why did it have to he her?

We'll have to talk to them Joe urged We've got to he polite—they're darned good customers

Mrs Miller didn't wait for them to make a move She skipped over to them talking as she came

Oh this is just wonderful she habbled You're the people I most wanted to see Let's String Along with the Model Garage Partners As They Help the Millers Shop for a New 1941 Car

#### By MARTIN BUNN

here I ve been coaxing Henry to buy us a new car and at last he has recapitulated capitulated I mean Now you and Mr Clark can help us pick out the one we should get

I sa'd maybe her busband hedged

Maybe always means yes Mrs Miller said archly I m sure it would save us

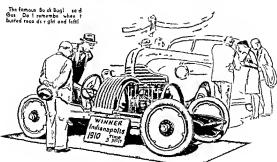
money in the long run

What sort of car are you people thinking
of getting? Gus put in to forestall an

argument
I just saw one Id love to have Mrs
Miller said Henry hash t seen it yet, Come

on-lets all go and look at it

She led the way down an alse lined with select 1941 care and Gus a quick and experience developed by the selection of the sel





That Gus told Henry Miller is the principle of the fluid clutch

brought up m front of a Super Eight Custom 180 Packard and announced brightly This is the one"

Gus looked at the big beauty. Then he looked at Henry and granned "That's quite a lot of automobile, Mrs Miller," he said. It looks longer than last year a model, he added to the salesman.

"The wheelbases of all our models are the san as they were last year," the salesman told hun, 'but the over all lengths have been increased by five or six inches, and the hoods are two and a half inches ionger."

the hoods are two and a half mches longer"
What I especially like about this particular car' Mrs. Muller announced unportantly,
are the really wonderful improvements
you can have on it. This gentleman told me
about some of them—mechanical refrigers.

tion and air conditioning, for example Just think, on the warmest day—"
'That's a wonderful stunt," Gus agreed, but it's fairly expensive, isn't it?"

The salesman pressed a button on one of the doors and the open window above it closed smoothly. He pressed another button and a glass partition slid noiselessly into place between the driver's and passengers' compartments. 'Fower operated," he announced proudly

"THAT'S a new, one on me," Gus admitted.
"Where s the gadget that run", R—under the front seat?" He examined the unit unterestedly and nodded. 'I see—a reversible electric motor hooked up to a hydraulic pump with a reservoir tank, and a hydraulic cylinder for each window. Murbity electric

The salesman realized that he was taking to a man who knew his automobiles. We have a number of improvements this year which I seldom mention to the ladies. L

so few of them are interested in such things," he said, "New connecting-role bearings And a new pressure cooling system. It operates a four and a baif pounds above the atmospheric pressure on the low-price '110 and the '120 models, and a sween and a half pounds above on the Super models, and raises the boiling pount of the cooling liquid so as to permit warmer engine temperatures at all allitudes'.

That's mteresting,' Gus said. 'T'd ie--"

But the conversation had become too technical for Mrs Miller "I think we'd better look all around before we decide on anything," she told the salesman 'Thank you so much"

Some one," Mr Miller said "was telling me about a car—I don t remember which make he said it was—that hasn't got any gears to shirt. That doesn to seem possible to me, but if there were such a car it might be a good one for my wife to drive She's always getting stalled ahriting gears, and you know how she chips transmission teeth."

"OU RE thinking about cars which have what they call the liquid clutch? Gus said. 'There are several of them. There's the Oldsmobile exhibit over there Let's have a look at their Hydra Matio Drivell's mighty interesting. But, say—we've lost your wife and See"

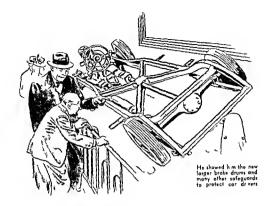
'Oh, they'll be all right—we'll run into them somewhere," Henry said with more than a touch of rehef in his tone. "I want to take a look at this new stunt you're talking about."

"It isn't altogether new," Gus explained.
'The Oldsmohile people are continuing it from last year, as optional extra-cost equipment. Know how it Works?"

'Nope," Henry admitted "I guess Im still just a Sunday driver who doesn't know a thing about cars" 'Well," Gus said, "you sell electric fans

in your hardware store, so you know something about them Now, suppose you hookeshoe fan up to a will plug, placed another fan not booked up, facung it and about an lach away, and then switched on the fan you had booked up. What would the other fan dn.—the tree can." "It would turn, too"

'Right' Gus said. 'In other words, the power would be transmitted from the drane fan to the free fan through the sir Well, that is the pranciple of the find clutch But its worked out in the form of a logued coupling in which oil takes the place of ar Two rators are placed in a case filled with oil One of them is driven by the engure II transmits the power through the oil to the other rotor, which drives the cars.



wheels In the Hydra Vatic drive the liquid coupling is used in connection with an automatic transmission assembly. There a no clutch pedal and no gearshit Instead there is an automatic control just below the steering wheel. It has four postiloss—neutral for parking bigb for normal driving low for steep hilts and heavy going and reverse for backing After you flip the lestrinto bigb you don't have to move it for normal driving—you steep on the gas pedal when you want to go and step on the brake pedat when you want to stop.

Well here are the Oldsmobiles—three sixes and three eights aying in size and price but all mightly pert and modern look ing Built in running boards which are exposed only when the doors are opened Scaled beam healdamps—they make flight driving safer One pace bood—when you lift it you enget at any place in the engine compartment without being a contortionist And Hydra Matile Drive it you want to pay extra for it. Lots of interesting features Henry Miller shook his head in admira

tion You're a wonder Gus be said You
just take one look at these new cars and
you know all about them

Ill let you in on something Gus con fided This is my second trip to the show today I came down to town early and when I met Joe for dinner I told him I d

gone to a mouse to kill time after Id fin the meter and so not tet on to hum, or he il never stop kidding me about it—be thinks I'm a nut on cars and I guess he a right! That reminds me theres one I missed this afternoot that I want especially to ace—that new Nash 600 they brought out to compete with Chevrolet Ford Flym outh and Studebaker in the low price field. I met an old riend of mine whos a big abot with the Nash people now and he told me that they d spent three years developing and road testing it and seven nillion dollars getting it into production Lets go and have a look at it

ERES their exhibit Gus said a minute or so later And there s the new 600 -its a classy looking bus isn't it with its torpedo type body and two tone finish It a a good size car too-194 mches over all George told me with full three passenger seats He said that it's built like a bridgethat the body and frame are a single welded light, but twist and rattleproof Another new feature is the spring sus pension-coil springs on all four wheels In tubes and integral with the shock ab sorbers-it a European idea The car has a six cylinder engine with the manifolds scaled into the block and they claim that an average good driver can get between

twenty five and thirty miles out of a gallon of gas Those other Nash cars are the Aeropowered Ambassador Six and the Aero powered Ambassador Eight They re in the low medium and upper medium price groups and they hoth bave twin ignition valve in head engines-they claim it's the nearest thing to an airplane power plant that you can get in an automobile

You say this Nash 600 was brought out to compete with some other cars Well lets go and look at those Henry

other cars suggested

Gus grinned at him You're getting the show bug he said Ali right-Im with you as long as my dogs hold out Here a the Studebaker exhib it Their Champion is in the low price group They ve upped the horsepower of its eix cylinder L-head engine to eighty by

making some changes in the cylinder bead and the spark plugs The cars longer and wider than last year s model but by cutting down dead weight they've kept it under 2 500 pounds Notice that there arent any running boards? Those larger cars are the Commodore and President lines You can get the new simstream Land Cruiser model in either Well wed better be getting along Henry There's a lot more to see in

this show

They got along Gus halted shortly to talk with one of the Plymouth salesmen How d Plymouth step its motor up to

eighty seven horsepower? he queried New camshaft infters was the prompt reply They raise the intake valves quicker and farther letting more gas and sir enter the cylinders with a rush There's a new intake manifold too that distributes the vapor better to all cylinders They ve added new bearings with five times the life of the old ones And that s not all That added power is multiplied still further with new rear axie ratios that give better getaway and pick up And a bigher gear ratio in second speed lets you use it for most of your starting without bothering with low unless you get in a snowdrift or mud If customers want it they can have a Power matic gearshift that uses vacuum to do most of the work In addition there s g. new oil cleaner and air filter

Hey Gus Henry managed to get in. Our times getting short

Thanking the salesman, they moved on

to Chevrolet and Ford admiring each in turn Both featured a host of new mechani cal accessory and design improvements besides carrying over from last year such advanced ideas as steering column gear shift and sealed beam headlights with Chevrolet again featuring the vacuum power shift and larger Tiptoe Matic clutch. Ford Mercury Lincoln Zephyr and Lin coln-all newcomers to the Auto Show this

year-were gone over from bumper to humner by Guss sp praising and approv

mg eve

Moving on they ex ammed the smart tor pedo bodied Pontiacs Henry was enthusias tic over their big comfortable bodies, and Gus over their precipitation type oil cleaners and new de sign safety eteering

n na to talk I ke the car ads myself! wheels They looked at the Grahams --- especially at the new Hollywood Custom model a long racy looking car with a body wider

than it is high and ite floor only twelve inches from the pavement

GUS SAYS.

Each year I wander haw the new cars

can be any better than last year and

each year at this time I find out!

They just keep an coming up with

more safety power economy com

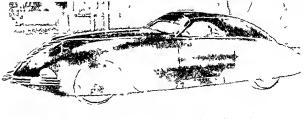
fort and looks! Gosh! I'm bean

Then they looked at the Chryslerslonger wider and lower than the 1940 They all have fluid drive-it s models atandard equipment on all eights and on one Windsor model Its optional on the other Windsors and the Poval Gua said It s the same fundamental idea as the Hydra Matic Drave but its worked out differently Chryslers have conventional transmission assemblies and clutch pedals but under average driving conditions you can shift into high at the start of a long trip and stay there the rest of the way On these 41 cara they ve combined flu d drive with automatic safety control which auits the gear ratio to every normal driving condition keeps the car under positive control and auto matically protects the driver on hills in traffic and on snowy or shppery roads

That fluid drive idea sounds like a mighty good thing to me Henry said Did you say that some other cars have it?

Gus told him as they approached the DeSotos To name a couple more DeSoto and Dodge And on DeSoto it comes with a new transmission But DeSoto is also available if you wish with a regular trans mission to which a vacuum type gearshift booster can be added

Those new safety rims on most of the Chrysler line keep you from throwing a tire when you (Continued on page 241)



With an arplane type mater and front wheel drive this fully stiermline car makes 115 miles on hour

## Is This the Motor Car of Tomorrow?

PEPLETE with striking innovations a roll on the highways of today is part of the Electric Utilities exhibit at the New York World a Fair Within an air condi tioned noiseless hody the driver sits be hind an instrument panel holding more than a score of dials and switches Above the panel is a green tinted nongiare wind shield and below a special crash board pad ded with cork and sponge rubber Doors are without handles and swing open at the touch of a button Easily removed panels of duralumin seal the underside of the car against dust and mud and eleven types of rubber placed at vibration points prevent rattles An all wave radio with two speak ers and an airplane type concealed an tenns can be tuned in from the instrument panel The driver operates the car through an electric gearshift. Four persons can st abreast on the wide front seat which

is formed of molded rubber to eliminate vibration and road shock Powered by an airplane type engine this car of the future can reach a peak speed of 115 miles an hour



Note the crosh board be neath the dash the padding of the top and the hinged section of the roof to make it easer to get in and out Above view of power plant





These views show the glaiep out rear-view mitto before and after adjustment to "dim" the headlights of a co-following just behind

#### Mirror Kills Glare of the Car Behind for Night Driving

INSTANTIA convertible for day or night driving a new rear view mirror cleverly turns a familiar optical defect into an advantage Look slantwise into an ordinary m rror and you see double. The silvered backing reflects ninety per cent of the 1 ght, giving a strong image and the outer surface of the glass reflects ten percent, giving a weak or "ghost" Image By using glass of wedge-shaped instead of flat cross section, the new car mirror separates these two images. In the daytime it is turned so that the strong re-Section from the silver back ing shows the road behind. At night, tilting it slightly upward eliminates the bother some glare of following head lights, which, bowever remain plamiy visible by their dimmed rbost reflection from the glass surface. Dotted lines to the accompanying photographs represent the reflection from the silvered part of the mirror

### Flash Light for Mechanics Can Shine Around Corners



P ped-light" flosh in use. At the right to fitted with a magnet to pick up ports

"Firsto" light ground corbers through plastic rods first applied in surgery now finds wide industrial use in a special fash light for auto mechanics able rods of various shaped duret illumination to hard toget at places. One type with a powerful little magnet em bedded in its tip can inti parts weighing up to three quarters weighing up to three quarters weighing up to three quarters weighing to the plant of the power the light.

## Car-Battery Charger Does the Job While You Wait

RECHARGING YOUR car a battery while you wait, a new portable unit takes an average time of only twentyseven minutes according to the maker Thus the operation may be performed simultane ously with other servicing A special motorgenerator set-the secret of the speed-up method-sutomatically varies the charging rate to maintain the maximum input that the battery s changing voltage and internal resistance will safely Electric dials permit a preliminary sixty second check-up on the battery which need not be removed from the car either for testing or charging



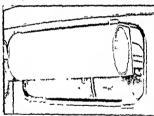
will charge the battery while you are having your car greased

#### Night-Driving Glasses Use Wire-Mesh Lenses

BLINDS BS of wire mesh in new spectacles designed for night driving are said to shield the eyes from the glaring headlights of oncoming ears Mounted in an eyegiass frame the screening absorbs enough light to prevent retinal fatigue, without interfering with safe vision



Wire screening in place of glass lenses cuts down the light that reaches the eyes



## Quickly Installed Air Cooler for Warm-Weather Driving

INSTALLED or removed in a few minutes, the new air cooler shown above fits any make of car Tittering and purifying the air besides lowering its temperature by evaporating a supply of water, the device operates automatically while the ear is in motion A pair of enterprising operators discovered a way to make a tidy summer profit with a supply of the conditioners One rented them to west-bound tourists at the Needles, Calif, gate of the Mohave Desert. while his partner collected and re-rented them to east-bound motorists at San Bernardino

## Here's My Story



## THE CAREER OF WILLIAM KNUDSEN



WITH AUTOMOBILES GAINING POPULARITY, THE BICYCLE FACTORY TURNED TO MAKING AUTO PARTS IN 1911, HENRY FORD BOUGHT OUT KEIM AND SOON KNUDSEN WAS IN CHARGE OF ALL FORD ASSEMBLY PLANTS



THE WORLD WAR PUT KNUDSEN BACK IN SHIPBUILDING HE WAS GIVEN THE JOB OF TURRING OUT FORDS SUBMARINE CHASERS FOR THE GOVERNMENT WHEN THE WAR FINDE TORD MADE HIM HIS PRODUCTION MANAGER



IN 1922. KNUDSEN
BECAME, VICE PRESIDENT
AND GENERAL MANAGER
OF THE CHEVROLLT CO.
THE VERN BEFORE HE
TOOK CHARGE THE COMMIN
SOLD DNILY 75 DOD CARS
DURING HIS RIRST YEAR,
THE SALES YOTAL
REACHED 240,000



TWO YEARS LATER KNUOSEN WAS ELECTED CHEVROLETS PRESIDENT IN 1933 HE WAS MADE EXECUTIVE VICE PRESIDENT OF GENERAL MOTORS AND IN 1937 BECAME PRESIDENT



LAST SPRING THE IMMIGRANT WHO HAD ARRIVED AT ELLIS ISLAND FORTY YEARS BEFORE WAS SUMMONED BY PRESIDENT ROOSEVELT AND GIVEN HIS GREATEST JOB—THE SUPERVISION OF AMERICAS VAST IMOUSTRIAL DEFENSE PROGRAM

## EIGHT CAR TIPS FOR

1 A HOMMADS SITHOGOPE for diag nosing motor list seasily assembled from the reproducer head of an old phonograph arm and a length of % steel rod 18 long. File one cut of the reproducer is the need to the reproducer up to the ear and moving the there are not the read of the rod around on the engine holes. — O DM output holes will quickly heate most engine noises. — O DM

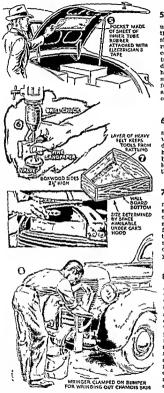
2 SERIAS TO DENTIO FINDES are facilitated with an ordeary small bench visc used as illustrated at the right visc used as illustrated at the right property of the series of the right property of the

3 FOR WORKING UNDER A LAR a piece of propoge rubher about 1' by 3' by 5' in size sewed onto the back of a me chanics eap provides a not cushon wherever he reets his head Beadles eithiniants any possibility of brushes and cuts should a sipping tool ordopped part cause the worker to jerk his head hackward and downward against the floor —N B

A SUILT INTO THE HUR CAP OF a rear mounted spare wheel an old dome light obtained from a junk yard can be a serviceable and decorative backing light for your car Cut a circle in the hub cap large enough to take the fix ture to which a single wire lead and plug are attached Then solder the fix ture to the cap to hold it and provide a gr und Connect a wire from the s ket by means of a plug and long wire to a switch on the dash and thence to one ammeter terminal. When you change a tire switch the hub cabs too so as to keep the light on the rear of the car ... S. A. T.



# AMATEUR MECHANICS



5 SAIS MICORDS AND OHER duta are stored close to a salesman a samples under the deck of his business coups if the deakes shown in the accompanying sketch is used. A sheet of inner-tuber ruber fastened to the underside of the compartment lid with strips of electricians a rubber adhesite tape, as indicated will keep all papers clean handy and dry. Motorist other than salesmen will find such a pocket use ful for storing booklets spare maps and other papers not needed continuously in the front seat—GEH

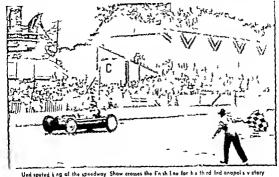
6 MIDDING VALVE SIEMS OF carbon and oil varnish can be accomplished speeduly by simply inserting each valve stem in turn in the chuck of a drill press turning on the drill and holding a strip of fine sandpaper lightly sgainst the stem as it spins Do not let the sandpaper touch the faces of the valves—HJ J

7 SIT UNDER THE HOOD IN THE unused space up ahead of the radistor in many care a tool box made as shown at the left is extremely handy I made one for my car out of box wood with a bottom of ordinary wall board. A fett highing in the bottom keeps the tools from ratiting. Naturally, the shape and dimensions of the box are determined by the property of the contract o

A DRYING A CHAMOIS QUICKLY and often while putting the finishing touches on a car wash is a tedious operation when it must be done by hand I found that an old clothes wringer could be used to cut the work down consider-Whenever I wash my car, I clamp the old wringer on the end of the front bumper and set my rinsing pail in front of it As often as necessary I souse the chamois in the water and run it through the wringer At some spot on the rear or front bumper of nearly any car, space can be found where the wringer can be clamped Otherwise any convenient support located near the scene of operations can be utilized -- L.JE



# IS HIS BUSTNESS.



## WILBUR SHAW, Three-Time Indianapolis Winner, Has Raced 40,000 Miles to Success

money winner in the annals of the historic track The brick oval on the outskirts of the Indiana city has proved a \$180 000 gold mine for Indianapolis s car crazy kid who used to pedal his bloycle fourteen miles just to catch a glumpse of his he

toes thundering into banked turns on practice spins

If some one had followed Shaw around with a candid camera recording in spap shots the most dramatic events of his life the first p c ture would show a cloud of dust rising from a gravel road in the year 1910 Just in advance of the cloud was Wilbur Shaw steering his first automobile at the age of seven Scorch ng along at twelve miles an hour he sat on the lap of a neighbor gripping the wheel of a p o neer Cole 8 and peering through the earliest of wind

shields a circular piece of glass clamped to the steering post in front of the driver

That early dust cloud was symbolic Shaw has been rais ng the dust ever since and has been go ng faster and faster in the process By the time he was

ten he was spending so much time at the speed way that even the drivers knew him He still re members the thrill he got when the first of these kings of the roaring road spoke to hm I wanted to drive a racing car so badly he recalled when I talked to him the other day in Indianapolis that I could almost taste it



Frst American driver to wear a crosh helmet he now also uses a pa la zed faht vso to ill glare on the track

### TEN DRIVERS I'M AFRAID TO RIDE WITH

I THE INDECISIVE DRIVER ls too slow He can't make up his mind starts to do this and on the trigger then changes to something else gets flustered in an emergency

2 THE COMPETITIVE DRIVER He sticks out his jaw

and steps on the throttle whenever a car starts to pass tries to best the train to the crossing is siways ready for a race with anyone anywhere any

thinks every highway is a speed time takes dangerous chances to win. WSY

3 THE SEE HOW GOOD I AM DRIVER

He is always showing off his skill at the trying to impress his passengers wheel give them the thrill of their lives sees how close he can come to telephone poles and how fast he can make the turns.

#### 4 THE SLESPY DRIVER

He drives himself as well as his car keeps on after he should stop with a etart

dozes at the wheel and comes to thinks he hasn't time for a stop by the side of the road and a short a pause that may save his life

#### 5 THE WEAVING DRIVER

He spends haif his time on the wrong aide of the road weaves in and out of traffic cuts around other cars and ducks back in line just in time to avoid a head-on col Helon

#### A THE TOD DRISERVANT DRIVER

He keeps looking back at cattle in pastures erops in fields pretty girls on the sidewalk watches everything but the road shead enjoys himself without ever realizing his danger



#### 7 THE JERKY DRIVER

He can t keep a ateady pace goes fast for a while then slows down without respect to road conditions snarls up traffic and prevents other cars from hit ting an even pace

#### & THE DRINKING DRIVER

He always thinks everything is under control that he is better than he is speeds and takes chances without realizing it

#### 9 THE TALKATIVE DRIVER He can t decide wheth

er his conversation or his driving is most im portant Кеврч turning around to see if the passengers in the back seat ars listening



#### TO THE PREOCCUPIED DRIVER



He has something on his mind 15 Blwats concentrating on something besides his driv comes to with a start just as he is head ing for the ditch a fire hidrant or a lamp-nost

At seventeen he quit school to drive for Bill Hupt a local manufacturer of dirt track racers His machine however wasn tone of Hunt's hundred mile an hour speedsters It was a pick up truck rolling about the streets of Indianapolis on errands Every time the youthful Shaw discovered an auto mobile part nobody wanted he cleaned it up and put it in a special pile of his own in one corner of the garage Finally he had enough

parts to fit together into a racing car About this time one of Hunt s drivers demolished his machine in a race at Winchester Ind Shaw got the motor and his home grown racer was complete It showed plenty of speed But it also

showed plenty of mechanical burs sooner was one defect proped out than another appeared To this day Shaw refers to it affectionately as the world a worst hag of hugs On July 4 1921, at the half mile dirt track in eighteen-Lafavette Ind year-old Wilhur Shaw shot away at the start of his first race 'Cotton Henning now his head mechanic was one of the competing racers At the end of two laps Shaw. hitting a turn wide open went straight out through the fence crashed rolled like a hall and got to his feet un hurt. The other Hunt drivers helped him hammer out the bent places in his car and get it rolling again after the meet was over Then they all raced back to Indianapolis just for the fun of it' Tearing down fences at

various tracks in the Middle West kept Shaw husy the rest of the summer He had a racing heart without the skill of experience. He tried to hurl his car into every turn with the throttle against the floor boards Usually before the end of a dozen laps he had disappeared from the track in a cloud of splinters But, each time, the young "fence huster" escaped injury In preparation for rac-

ing, he had practiced tumbling and gymnastics so he could fall and roll without hreaking bones In addition, whenever he saw a crack-up coming he "went to the hasement," sliding down as far as possible

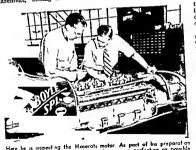


Heaning his head mechanic Henning was a rival in Shaw's first race

into the cockpit to get maximum protection. All told Shaw has been in more than 200 crashes Yet he never has been seriously burt. Today, after nineteen years in the racing game he is unscarred Athletic and clean-cut, he looks as

though he had been cast in the role of racing driver by a Hollywood director By the end of that first

summer, the hoy driver was demonstrating that he was a 'natural season ended in a hlaze of glory At the old Hawthoroe Track, in Chicago, his bag of hugs led the field to carry off the cov eted Bernhach Trophy There followed years of dust eating at leading tracks throughout the country During one race, at Detroit, dusk closed in hefore the contest ended and when one car went out through the fence Shaw saw two others fol-



Here he is inspecting the Moserats mater. As part of his preparation for a contest he helps tune the car to as near perfection as passible



Show where dust off his visor with a chamos ted to the steer g wheel by an elastic cord in the hata below Show shows how he holds the wheel du ng the gruel ng t ve haur g nd of the 500-m le roce class c



The photo at the loft shows the crosh but ton on the wheel for cutting the gn t on fac och is threatened

more than 100 mules an hour without the and of a rehef driver Counting both trial runs and races Shaw has chalked up more than 20 000 high speed miles at the Indian apolis oval

In preparation for a race he trains like a track athlete He eats I gbt meals Break fast, for example consists of bouillon and bread and milk. This year he tried taking gelatin for three weeks before the race as an aid to staming, and believes it did him good. The constant vibrat on of the rocketing cars leaves the drivers sore from head to foot at the end of a 500-mile grind. During the four hours and twenty four minutes it took to complete the 1937 race Shaw had eleven pounds hammered off by the jarring of the brick bowl

In the saga of this speedway some of the outstanding mo- (Continued on page 239)

birdshot By 1929 Shaw was at the top of the game races he carried off nine firsts. The American Automobile Association hamed him the year's National Dirt Track Champion of the

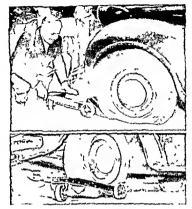
Two years before that, in 1927 he had achieved his boyhood goal When the varicolored cars roured down the brick straightaway at the start of the Mem orial Day race Shaw was bunched over the wheel of one of them. Screeching along the

vast, banked oval, he fought his way past veteran drivers and landed in the money

United States

plac ng fourth. Year after year since then. Shaw has been one of the thrill drivers of the his toric track. In the last four races he has come in first three times and second once In the last seven races, he has averaged

surface of the 3 200 000 bricks that form the



In the upper picture Larry Kieffer demonstrates the use of his corcrutch which holds a flat tire off the road until it can be changed

#### Dolly Spares Flat While You Drive to Nearest Garage

This dilemma of motorists -whether to change a tire and soil a good suit or drive the flat to a service station and risk ruining the tireseems to have been solved by a simple device produced by Larry Kleffer, of Philadelphia, Pa It is a lightweight, three-wheeled dolly which can be carried in the luggage compartment of In case of a flat. any car the dolly is placed in line with the wheel and a spiked boit is screwed down to engage the surface of the road and prevent the dolly from moving Then the wheel is run up into the cradle of the dolly, which holds the injured tire from contact with the ground during the drive to the nearest service station or CRIRGE A swivel wheel makes steering possible.

### Dashboard Keyboard Operates Car-Exhaust Calliope

UNFR the hood of the automobile owned by Leo Feuchter, of Ironton, Ohlo, is a homemade calliope which is powered by the exhaust of the engine and played by means of an organ-type keyboard at the right side of the dashboard Depending upon the speed at which the motor is running, the sound of the calliope can be heard from six to eight blocks away. To start the music, the operator presses a pedal, diverting the

ed exhaust gases into the instrument The range of the callione is two octaves. Feuchter, a sixty-five-year-old automobile mechanic, designed and constructed the unique installation, which has attracted wide attention in parades and at conventions the





Calliage pipes installed under the hood of a car Played with the two octave keyboard seen at the left, the instrument uses exhoust gas



#### New-Type Reflector Is Flomeless Flore for Stalled Vehicles

Mouses reflectors that give of a brilliant red warmg light when struck by beams of the headlights of an approaching car are now ava., able for use as -- ameless flares" behind stalled trucks or automobiles. The disas of plastic material are con amed in a metal housing with hinged covers.



#### Battery Pliers and Terminol Wrench Are Servicing Aid

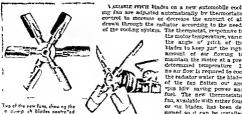
Two tools in one are prorided for the service man by a new pair of battery ple's shown in the illustra tion above. The angle of the jaws enables the phers to grip corroded or damaged battery terminal nuts, while at the end of each handle is a box wrench opening one mch and the other 9 16 inch, for use with noncor ros.ve-type terminals. The new drop forzed triple plated fool is made of chrome-vanadium steel



### Spray Gun To Reoch Cor Squeoks Fits on Oil Con's Screw Top

ELIMINATING car squeaks is simplified by the use of a new spray gun which fits any etandard ecrew top can of oil and throws a fine stream of the lubricant as far as the entire length of the car The inverted feed writem enables the worse gun to use the last drop of oil in the car. The fact that the can is directly over the handle of the unit makes the gum easy to operate the manufacturer declares.

### Variable-Pitch Fan Blades Control Heat of Car Motor



by a t emostat a the endiator

mg fan are adpasted automatically by thermostatic control to merease or decrease the amount of air drawn through the radiator according to the needs of the cooling system. The thermostat, responsive to the motor temperature, varies the angle of pitch of the

blades to keep just the right amount of air flowing to maintain the motor at a predetermined temperature no air flow is required to cool the radiator water the blades of the fan flatten out and "pin ldly saving power and fuel. The new thermostatic fan, available with either four or ax blades, has been de signed so it can be installed on many car mo ors.

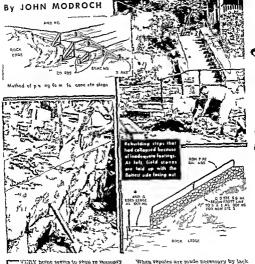
AUTOMOBILES

# HOME and WORKSHOP

Masonry Repairs That Save You Money



# **Masonry Repairs**



repars from t me to time. Many of these are so single that any handy these are so single that any handy by it is necessful by it is necessful by it is necessful or course and morfar for various purposes and the is covered in a fabilition on a following page. It is also important to understand the general procedure for various types of repairs. Ind vidual jobs all duffer but the accompanying filturations show how to solve a number of common problems confronting an amateur mason.

When repairs are made necessary by lack, of a sold underground foundation the first thing to do a lay an adequate foot ag for the new masonry. This usually calls for d gg ng a sheer sided trench to the required depth into which a mixture of concrete and large stones is noursed.

In mid localities the footing need not go very deep but where iong cold winters pre all a depth of several feet is necessary. To be on the safe side foot nga should start below the lowest possible frost line or depth to which the ground freezes. It is custo

# That Save Money

mary on small projects to extend the foot ing several inches beyond the width and length of the structure. Use can sometimes be made of large burled stones and rock ledges as solid footings for masonry work

The steps illustrated formerly ran down the slope in a long straight line. When extensive repairs on them became necessary because of their nadly cracked up condition they were rebuilt so that adequate footing could be provided. In order to make use of a buried rock ledge that lay under the lower end they were redesigned into the shape of a T with the ledge serving as footing for the landing. The old cracked steps were then sunk into the slope to provide footing for the new steps buth over them.

mers and axes should not be used Retaining walls such as those flanking the lower flights of steps should be laid with a slight backward tilt in order to increase their stability A back fill of loose stone can be thrown in behind the cemented facing to add further retaining strength to the wall

If large flat field stones are not available cut flagstone of the kind usually sold for walks and terraces may be used for laying a smooth tread on stone steps

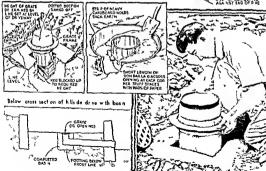
When concrete steps must be cast on the sloping side of a rock ledge wooden forms of the type commonly used for casting steps should be prepared as shown in drawing

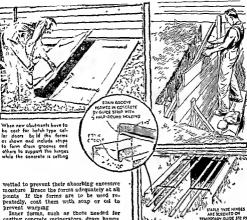
Wooden forms for casting concrete should be built of green lumber or boards well

### DRAINAGE BASIN

A boan of the type should be located of the lowest point and the surface of the road p tched loward to the boan a cost square as or 1 ght but the upper part a creulor in shope







esting concrete incinerators, drain basins, fireplace ash pits and similar jobs, should be made collapsible Two simple tricks for doing this are illustrated In some cases it; is not necessary to make

all walls collapsible The buckling of two opposite walls will free the adjacent walls-or the third wail and ceiling depending upon the type of form hemg used. All sections of the collapsed form must, however, be small enough to be pulled out of whatever opening exists.

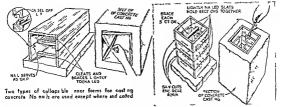
Short cut's in assembling liner forms are often possible For example, a 12" square packing box and part of a common mal keg were combined to make up the inner form used for casting the hillsade driveway drain basin linearitied. The bottom section, to will be noted was cost square in order play to the control was cost square for order play. The property of the prop

The strength of concrete mixtures varies with the cleanliness of sand, gravel and stone and other aggregates mixed with the cement and water. The presence of top soil and other impurities prevents the

cement from completely coating every particle of sand and aggregate In other words very clean sand and aggregate require less cement to form a concrete suited for a given job than sand and aggregate containing impurities

Fine textured concrete should be made by first mixing dry cement with dry Sand and then adding the required amount of water When making coarse concrete, howaggregate, such as coarse gravel, crushed rock or cluders after the cement, sand and water have been mixed into a batter Then add more water to readjust the liquid content of the batch. It is customary when sand, and aggregate for muxing a given classed concrete to use three figures as 1.2.5. The body of a discarded whether/over

into the top of a sturdy knee high stand built of scrap wood makes a handy set up for msting concrete required for ordinary home repair jobs. Its convenient height eliminates the back strain that goes with



mixing on the ground and if used indoors the floor under it can be swept up regularly Of course a wooden box can be substituted

for the wheelbarrow body
Mixtures recommended for various gen
eral types of concrete work
are given in the two tables
Either table can be followed

HOW TO

accurately by using a box for measuring the amounts of cement, eand, and aggre gate in the proportions

called for

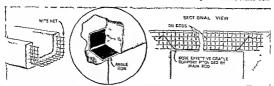
In order to add just the right amount of water to the dry mix if Table No 2 is used it should be added carefully a little at a time Meanwhile the mixing should be continued When the concrete becomes pila ble like a batter it is ready Any evenes water in connerte reduces its round's the mixing of the mixing of course the mean of course be mean used beforehold the mixing of course be mean used beforehold.

Stones of various sizes can be dropped into the form along with concrete when casting abutments such as those supporting the hatch type cellar doors To avoid rotting of the wooden sills commonly used as lange bases for doors of this kind it is a good idea to eliminate them and anchor the hinges in the masonry

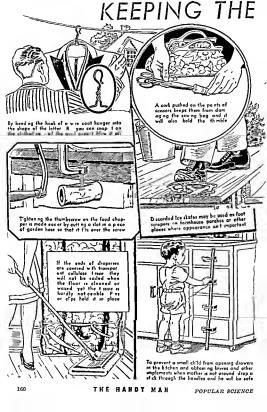
#### HOW TO MIX CONCRETE FOR ANY PURPOSE

Type of Work	Tobia I			Toble 2		
	£e- ment	Water	Ordinary sand gravel	Ce- n ent	sand	Agere-
Class A Concrete exposed to se ere action of water frost and wear-pos s and drives	cu. It	Eal	Addenough lo make approx 3 cu ft of concrete	1	2	3
Clase B Concrete exposed to moderate action of water frost alkali and near steps and septic tanks	cu ft.	54 gul	Add enough to make approx 4 eu ft of concrete	1	2	4
Class C Concrete protected from act on of water frost and a kali-re taining walls and foundations	eu st	gul gal	Addenough to make approx 5 cu ft of concrete	1	2 5	5
Class D  Lon strength concrete  -foundation footings	eu It	71/2 gai	Addenough to make approx 64 eu tt	2	3	8
	t bag af coment I ta ft.			Add water as required		

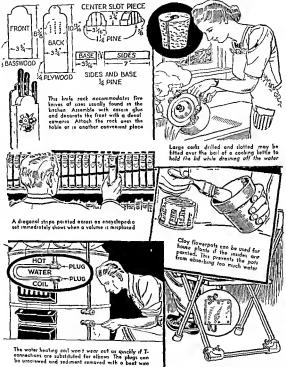
Use 1 part coment 3 parts send 1 part I me as a mortar for brick t le stone Use a 12 m x for the finishing copt on two course work



Methods of reënforcing concrete (1) tanks and broughs (2) over openings (3) when used for beams



## HOME SHIPSHAPE



Leather 'shoes' will keep the rear legs of metal folding chairs from damaging the carpet or floor Rubber crutch tips can be fitted over the front legs



TO SIMPLIFY the use of a cheap mk for posters and other rough printing one pinter keeps the ink in a grease gun the tip of which is fitted with a short length of rubber things. As the ink is forced from the gun the hose is employed to spread it smoothly over the plate—G E HADSHIKMON

#### Rat Trap Holds Grain Sack on Spout for Filling

FILLY 0 sacks of grain from an ordnary grain bin can be hastened by making use of the method illustrated for holding the sack on the spout. A large rat trap of the ordinary back breaker type is nailed on one sade of the end of the spout after the striker wire has been bent to the triumpular shape starter and pull the lip of the sack throught it. The spring tension will keep the sack in place—E. G



## What's Wrong?

INSPERENCED painters make many mistakes some of which are illus trated below. Can you spot them? Figure 1 shows how an amateur started to paint some panels on his sun porch. In Fig. 2 he is painting a chair He always makes a practice of washing his brushes after use and keeping them in a standing the top of a small table. Whenever he finds bad dents that have to be filled with putly applies the putly as in Fig. 5. His mistakes are explained below but try to discover them for yourself.



THE STATE OF THE S

# \$100 IN CASH The Ideal



F YOU were given the job couldn't you design a better medicine cabinet than the one you have in your bathroom at home?

We know you il say 'yes,' ao we challenge you to try it And to stir up a little friendly competition we will award the following cash prizes for the best designs submitted

FIRST PRIZE	\$50
SECOND PRIZE	25
THIRD PRIZE	15
FOURTH PRIZE	10

Plan the cabinet to hold standard remedies such as those in the accompanying list, as well as toilet articles, prescriptions, and other essentials. It may be of any materials, with or Medicine Cabinet

without illumination, but should be of reasonable size and of such construction that any competent amateur craftsman could build it without difficulty

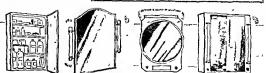
Make a clear, dimensioned pencil drawing or sketch of the design, and prepare a list of materials and brief description. If you have actually built the cabinet, send a good phote as well. Mail your entry to the Contest Edutor, Popular Siensey, Movillar, 333 Fourth Avenue, New York, to arrive on or before November 30, 1940. The contest judges will be the editors of this magazine, whose decision will be final. No entries will be returned. In case of ties, each tying contestant will be averaged the price to contest in the specific of the contest is open to all except employees of this magazine.

## WHAT THE FAMILY MEDICINE

The following 1st is based upon recommendations of the United States Department of Labor in a backlet. The Hame Medicine Cobinet

Toothbruther - Tooth poste powder, or Inquid - Scussers Showing siserbids - Rubbing alcohol - Barre acid powder Tincture of radius - Apprim - Aramatic spirit of ammonia Tannic acid powder - Petrolotum - Sirup of specie - Tweesers Dental files: - Sadium biscorbanche - Clinical theirometer

FIRST AID DRESSINGS 12 assorted bandages roll of sterile gazer roll of adherive platter, roll of absorbent catton ONE OF THESE Mineral oil mineral oil emuls an cascara sagrada milk of magnessa sadum phosphate, cattor oil



The cobinet may be either the built in ar the plain wall type and with ar without lighting fixtures



#### Humidifier Moistens Air and Reduces Dust from Hot-Air Furnace

May homes with warm are furmaces suffer from a lack of moisture
and get plenty of dust from abak
ing the aches especially when there
is a cold air nilet or return equipped
with a sid to vary the amount of
cold air taken in off the floor When
this side is open and dust can cr
culate throughout the house. To
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of water in twenty four hours The tank is filled each day When the cloth cover becomes dirty it is thoroughly russed under a faucet.—APTHUE STROIM

#### Corrugoted Cardboord Gives Cool Grip to Hand Grinder

INEXPENSIVE hand motor granders are usually not equipped with forced ventilation and therefore become bot when used continuously A cool grap can be added by taping corrugated cardboard around the handle





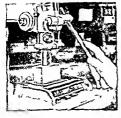
#### Nonslipping Desk Blotter

A HEATY rubber hand placed across each corner of a desk biotter will keep it from st ppung on a smooth desk top. To install the bands remove the biotter from its back hig and snap an elastic across each corner then sign the blotter back into the corner pockets. The bands are covered by the blot-ter on the top and are exposed only on the underside—CALI, L. SAWYER.

#### Metal Machinery Stand Adjusted to Suit Uneven Shop Floor

MFFAL stands for v codworking machinery that have legs of the type shown can easily be adjusted to rest solidly on uneven concrete floors. A short of the standard of the solid control of the stand rest firmly on the floor. The upper not is then tightened to lock the bott in place. Some times it is was to place a small square of short interest that the solid control of the solid floor is sold to refer the solid floor is sold to the concrete crushly. This method of adjustment insures a steady bench.





#### Small Printing Matrices Made on a Drill Press

OW-CRS of small printing presses who also have access to a workshop drill press can use the latter to make matrices or mats of type or cuts Place the form containing the type on the drill press table. Wet a piece of mat stock and lay it over the type followed by a pad of rubber (cut from an old inner tube) and a wooden block Center the block and type heneath the chuck and feed the spindle down with considerable pressure

If the first application of pressure does not make an even clean cut im pression the mat can be slipped back in position over the type and the operation repeated a second or even a third time—VFRNOY B CASE



## Hold Screws and Nuts

IF you are able to lay your hands on empty glass par containers of the new type that are equipped with your top covers you can use them to advantage for holding a selection of nuts screws and other small shop materials The large spout works like those commonly found on boxes in, which table sait is sold. The covers screw on the jars

#### Tooth from Hay Rake Holds Pipe Under Hand Pump on Farm

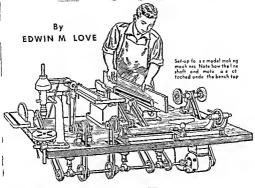
To NOD the tank supply pipe under a pump sport in such a way that it can be instantly at tached or released a discarded spring tooth from a hay rake may be used as abown Bend a loop in the end so that it will engage the hail of the pipe how! Anneal the end if necessary to do this Then drill a hole through the pump platform to receive the opposite end of the tooth



#### Adhesive-Tape Strips Strengthen Weak Sections of Stencils

WHEN you purchase a new paper stencil in spect it carefully for harrow ties. These have a tendency to break and fail out so cut strips of adhesive tape of the correct width and reenforce them as shown. This helps to make the stencil last indefinitely.

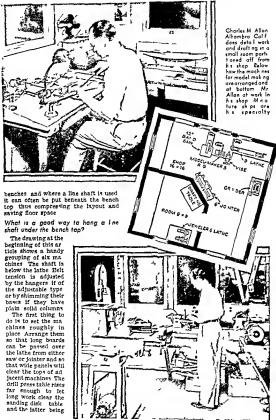


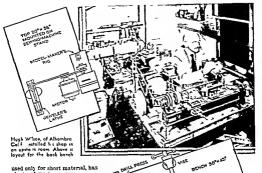


## **Workshop Layouts**

### FOR SMALL WORK and MODEL MAKING

MATEUR craftsmen who favor small nov H HE CHT OF MACH NE elty work or model making can make PULLEY CENTER use of light woodworking machines L NE SHAFT PULLEY grouped together in a comparat vely CENTER DROP small space From the r standpoint a countershaft BELT LENGTH FROM and line shaft drive can be made really satisfactory No matter how small OF PULLEYS the projects themselves POSIT ON OF PU LEYS ON MACH NE may be and how much of the work is done by hand. BELT HOLE It is always more conven ient and econom cal to use machines in cutting stand ard stock to the smaller s zes required Plans for shop equipment should keep this in view Light machines driven from one or perhaps two Method of locat nath motors perform well on moch nesw h ego dta platforms or single belt ten on and ho as





used only for short material, has plents of working room Now check the belt lengths by

looping them over their pulleys and noting the distance from center to center Mark these values down for later use Shp the pulleys and hangers on the line shaft, and boit the hangers to a line Adjust the end ones so that the shaft turns freely, and then the center one As the motor itself has a pul-

ley for driving the polishing head locate the motor to suit and shim it away from the bench top with wooden blocks. If ac curately placed, the motor can

be attached to the shaft with a solid coupling but a flexible coupling is better because it will take care of slight irregularities. The motor must be capable of running m a hanging position

The location of the machines with regard to seit tension, as well as the position of the holes where the belts pass through the beach top are plotted as shown in an accompanying sketch. Draw on paper a section of the bench top to any convenient scale it does not have to be full size Mark the center of the line-shaft (distance d) and draw a horizontal line marking the beight of the machine pulley (h) Set a compass to an are equaling (to the same scale) the ex perimental belt length obtained before Center the compass on the line shaft and strike an arc through the machine-pulley height line

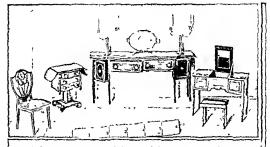
Dagram showing the arrangement of the much nes Draw carcles to the same scale to represent the size of the pulleys. Connect them with

lines indicating the belt. The position of the bole through the beach is then easily scaled. When the machines have finally been set in their permanent places, align and tighten

the pulleys on the shaft. Cut a hole under the saw and another un-

der the sounter through which are dust and shavings can drop Place a box or, still better, a deep drawer beneath to catch the litter If the bench is closed in, provide a removable panel or drop door on the countershaft side

As all belts except the one in use are removed from the machine pulleys it is well to meert books or pegs in the bench top to keep the belts from slipping through the holes,



Madel furniture constructed by Mr Wilson Every Little detail is complete The drawers slide in and out and the doors open on scale hinges. Note the 8° ruler in the foreground

### How should a shop be laid out for model making?

That is so much an individual matter it is hard to give definite rules. Perhaps the best answer is to show two typical shops of experienced model makers.

One shop illustrated is that of Charles M Alian, of Alhamhra, Calif, who started in 1927 as an amateur by building a Spanish galleon model from plans published m Popular SCIENCE MONTHLY Mir Allan has graduated into a professional whose products are marvels of craftsmanship and sell for high figures He has provided yacht models for such notables as George Converse, Preston Sturges the movie playwright, Donald Douglas, of the Douglas Aircraft Co, and Jascha Herietz, emment violinist, Lincoln Ellsworth, the explorer, ordered a miniature of his famous plane, Polar Star Mr Allan also drew plans for many ship sets in the motion pictures 'Barbary Coast," 'Hurricane, ' and Dodsworth."

As you will see from the plan of his shop, be uses plently of bench and window space Along the west wall he groups his hand saw, latbe, use, and model-maker's rig, hut the latter, being portable, is travally found near the work at hand Drafting and small detail work are done in a room partitioned of from the shop, where there is a small bench with a pewelers lathe and soldering equipment

Hugh Wilson, another professional model maker of Alambra, does most of his work in a bedroom. Although a shp-model errort, he now majors in Ho locomotives and miniature furniture. His expert craftsmanip and wide experience make the layout illustrated in the drawing well worth studying. For reducing large stock to usafile such to safely and saw, circular saw, and jointer.

For many of the layouts described in this article and the preceding one a motor with a reversing switch is required, otherwise the belts on some machines must be crossed.



Mr Wilson's interests cover many phases of the model moking field. Here is a locomative he built



### Identical Wooden Wedges Cut on the Circular Saw

To cur any number of identical wedges quackly on a crecilar saw make a mg out of scrap lumber as shown. The stock from which wedges are to be cut in placed in the mg and the whole pushed along the ripping fence which is adjusted so that the blade just clears the mg Waste can be eliminated just clears the mg Waste can be eliminated wedges but there there in the make with a mater gauge set to 90 deg — H. WALTON



### Two Short Clomps Combined to Form a Long One

USES of standard clamp attachments of the type made to fit on lengths of pape can convert two short clamps into a long one by joining them in the manner iften trated. It is necessary only to give the siding jaws which are free to revolve on the pipes a quarter turn in order to butt them together alongside the work.

### Auxiliory Fence on Jointer Forms Chomfering Trough

CHAMMERS of any size can be cut ac curately and safely even on a small jointer if a 45 deg wooden fence is added as shown below so as to form a guide trough The work sunks down until supported by both fences. It is therefore impossible to cut too deep all cuts are the same size and stop cause the work as supported by both sides instead of merely the uncut corners as is the usual practice.

The work can be turned end for end and the cut can be started at each end of a stop chamfer thus insuring clean cuts at both ends Even the ends of narrow boards can be chamfered — JOSEPH WILLIAMS





Above the fence in place Left how work a held Be low fence in use



### Colored Pencils Used for Imitating Inlaid Borders on Woodwork





AN INEXPENSIVE process which uses colored pencils to produce the effect of inlaid borders on furniture and other wood work is meeting with success in the Boys Club and three public schools of Pittsfield Mass It has been especially popular in the

schools since the drawing and color work can be done partly, at least in art classes. It was introduced by Walfrid T Victoreen manual training instructor. The

steps are as follows

1 Mark outlines of border with a marking Rauge 2 Pencil the growes to make the lines distant 3 Trace the chosen design (peppermint stick stripes are simplest) in light pencil marks and fill in uniformly with colors If mistakes are made they can easily be corrected Simply sandapper the surface and start all over again 4 Finish the entire surface with several coats of shellac and rub down with fine steel wool between coats.

This process can be used on stands tables utility boxes book racks book ends smoking and sewing stands and many other pieces of furniture or craftwork novelties



Four steps in decorating a small ponel for a furniture project Because of its amplicity the method is very popular with boys

#### WHITE PINE

#### [ WOODWORKING ]

Color—Heartwood, cream to light reddish brown, sapwood, white to pale  $\ensuremath{\text{Nory}}$ 

Properties—Soft, lightweight, and quite strong, close, fine, straight grain, compact, even texture, shrinks moderately, easily worked and nailed, durable outdoors

Paint—Takes paint very well Priming coat should be rich in turpentine and inseed oil second and third coats less so Paint on sappy spots should be allowed plenty of time for drying Stain—Takes water or oil stains readily to give good browns,

Filler is optional

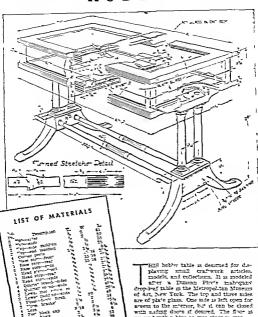
Uses—Furniture boats, building materials, foundry patterns.

boxes, and musical instruments

FORULAR SCIENCE MONTHLY SHOP DATA FILE

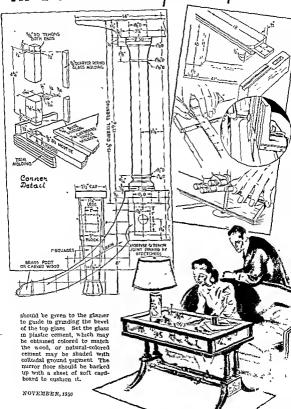
Designed by DONALD A. PRICE

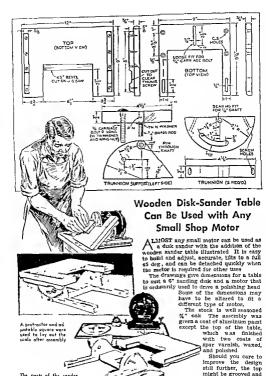
# HOBBY TABLE



covered with a blue or ruse glass mirror.
The following place glass a thick is recurred 1 po. 174, "by 574," or the top. 1 po. 45," by 55' for the xide, and 2 po. 45," by 15' for the ends. The mirror floor is 516' by 15' by 55'. The top frame

in Duncan Phyfe Style



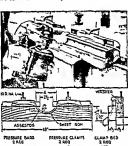


The parts of the sander table with one frunnion

and support put together

### Easily Improvised Clamp Holds Band Saw for Brazing

THE inconvenience and delay of sending a broken band saw blade away for brazing may be avoided by making a clamp as shown below and doing the brazing your self. Line the circle in the center of the block with sheet iron and asbestos paper to protect the wood. The brazing is done in the usual way except that with a home made clamp of this type it is necessary to wind the joint tightly with fine soft more and push a small brad under the top wires to hold the tapered ends in contact.



The center of the block is I ned with sheet ron and osbestos paper to protect the wood I am heat

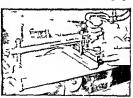
#### How to Clean Rasps and Wood Files

Clogged teeth of rasps and wood files can be cleaned by pouring alcobol over them setting it alight and then brushing off the tharred particles of wood with a file card.



### Miter Gauge of Circular Saw Improved by Adding Handle

The inter gauge of a circular saw is case to use if provided with a comfortable bandle. Trace the outline of a bandsaw bandle on a piece of 1 oak or other suitable wood and leave some extra wood at the bottom. Shape the bandle with band saw rasp and sandpaper. The exact method of mounting will vary but in the case illustrated a piece of steel bar stock was cut and drilled to form a link between the wooden handle and a stud on the gauge.



In this case the hondle is held by a steel stip dilled to receive the studion top of the gauge

### Ends af Auger Bits Protected by Cardbaard Caps and Carks



WHEN auger bits are not carried in a bit case they can be protected as shown with short sections of medium or heavy weight mailing tube forced over corks or softwood plugs if cardboard tubing of the right size is not at hand pieces of bose or rubber tubing may be used This method protects not only the bt server but also the cutting spurs and lips—W C W



When lacking these can be installed by the method illustrated First bore up from the cellar into the

partition just to one side of the fireplace (Fig 1) A snake wire is next passed up (Fig 2) to make sure the space is open the entire way up to the mantelshelf Both ends of the snake have a hook formed with a pair of phers The upper hook wilt be caught in the partition with another snake wire inserted from above. At the lower end a trimmed end of BX cable is wrapped on just ahead of the book

The board usually found at the back of the mantel is removed by driving in the nails with a nail set and gently prying it off A small hole is made at the extreme left (Fig 3) through lath and plaster Another hole is cut just to the right of the first stud The second snake wire is now pushed up through the latter to make sure the space is open to the point chosen for the light The book on the original fish wire inserted from the cellar can then be caught by the hook on the end of the second snake and pulled out Continue to pull until the BX cable is out of the hole sufficiently far to

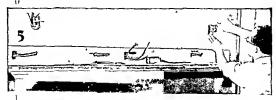
reach the light outlet The cable is now carried to openings made in the plaster and lath corresponding to the locations of the outlets From the first bracket outlet a piece is carried to the clock outlet and from there a piece runs to the right hand bracket opening. Where a stud has to be crossed and no space is found at the back as was the case bere a shot is made across the face of each study capable of taking the thickness of the cable Red fiber bushings are inserted on the ends of each cable as required by the Electrical Code (Fig 4) Take care to keep all work within the space covered by the backboard Install the two switch boxes at the bracket outlets (Fig 5) with their ears flush with the plastered surface and use 1" No 4 flathead wood screws Make sure the ends of all BX are brought into the boxes through the knock out armor

The backboard is prepared by cutting a

ELECTRICAL



How the wring is carried across in the space that is to be covered by replacing the backboard



. The boxes at the brocket autlets are installed with their ears flush with the plastered surface



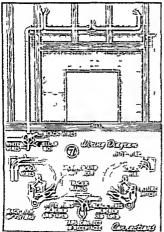
The canne on setaldeed then the fature s farened whas witch box barrype and knob

hole n the center to fit a box for the receptacle The backboard is then replaced and the box and receptacle are installed Use £ flathead wood screws to secure the box. The r ght hand bracket n F g 6 has been

A name at wood series to serie the box. The right hand bracket n Fig 6 has been connected and the left one as having is points soldered A sw tich box bar n pple and knob are used to secure the fixture to the wall. Use both rubber and friction tapes on all joints. The connect one are shown in the dagrams (Fig 7)

In the cellar the BX is run to a su table pon twhere a connection can be made in this case a cable happened to be running along the bottom of a time nearby feed ing a base receptacle above. The staples were loosened and enough stack could be pulled back from the turns where it was que te loose so a 3 junct no box could be cut in as shown in Fig. 8 in come cases it might be necessary to run the BX to the cellar 1ght box or perhaps the meter beard If the house wring happens to be of

the count happened the terrety is much to better to substitute nonmetallic sheethed cable for BX in wring the mental because this meterial is considered safer to use with open wir ng When us ng e ther type of cable observe the Code rules cell ng for a running board where timbers are to be crossed This is first na led up to the timbers and the cable secured to it.



38

Whe a BX cable has to be co ed ac as fao beams in the ce o t is necessary first to not up what is called a uning bood

### Night Lamp Back of Bed Lights Room Faintly



ord or more is dilled for the toggle are tel

DESIGNED to give the minimum light required to see faintly around a bedroom, this night high will not disturb another person siesping in the same room. It is an invaluable aid for example in seeing if a beby has become uncovered in his crib

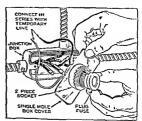
The light is from an indirect T watt lamp plugged into a double utility outlet behind the headboard of the bed. A bed lamp is plugged into the other side of the outlet. The circuit is controlled with a toggle switch, which is mounted by drilling a small.

hole in the headboard On the rear of this switch is a round metal box in which all the necessary connections are made and the wires spliced soldered and hound with both rubber and friction tape

Small metal molding is used to protect the wires between the switch and the double outlet. The latter is changed into two separate outlets by cutting one terminal plate into two and filling the space with sealing wax. One outlet is wired through the toggle switch for the night light, and the other or extra outlet is wired directly to the line as shown in the diagram so it can be used for a reading light and operated independently of the night high The wirning must be of a thoroughly protected, safe type such as would meet with the approval of the Fire Underwriters.—A L. BUYLICK

### Plug Fuse Serves as Switch in Temporary Circuit

WHEN a temporary electric circuit is needed both fusing and switching facilities can be provided by the method illustrated After making the dearred connections in an outlet or junction box replace the cover of the box with one having a single outlet hole. A blank cover can be cut out to serve this purpose, if necessary into this, insert a two-piece porcelian lamp socket which has been wired in series with the temporary circuit. A plug fuse of suitable blow-out rating completes the job Unscrewing this fuse disconnects the circuit.—J M.





### COMPLETE DARKROOM FACILITIES COMBINED IN ONE SMALL CABINET

WENNER

### Portable

OMBINING all the necessary features of a large darkroom into one compact, portable unit, this photo 'lab' should appeal to the camera enthusiast who lives in a small apartment or is otherwise limited for space. A place is provided for every necessary ftem, yet the cabinet liself is small enough to be stored in a closet or out of the way corner from which it is readily hauled into the darkened kitchen or bathroom so as to be convenient to a sink. Only one electrical connection need be made to the nearest outlet and you are ready to operate

The pictures and drawings are intended to convey the general idea of what can be done, rather than specific instructions for building this unit Every camera fan has his own ideas as to what equipment is most necessary and can readily alter the design

to suit his own needs

The darkroom compartment is of adequate size for loading film into a daylight developing tank, and on occasion can even be used for tray development of cut film! It should be painted with dull-black acid-resisting paint, or, lacking this, a coat of duil black paint followed by a coat of hot paraffin. The sleeves are a double thickness of light-tight black cloth, sewed to form cylinders measuring 5" by 15", provided with elastic, and glued to rings cut from 14" plywood. These rings are then fastened to the side of the darkroom with the cloth between

A door in front of the cabinet gives access to the darkroom and also provides a handy shelf when opened A book or chain holds it level Felt weather stripping is used to assure that this door will be light-tight.

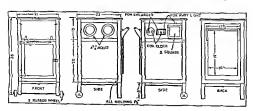


Photo "Lab

The darkroom proper does not extend the entire width of the cabinet. A 14" plywood partition separates it from the electric service compartment. The outside face of this compartment, also made from 1," plywood is removable for working on the wiring The duplex plug triple switch and ruby light are mounted on this panel

The ruby light, used when enlarging, consists of a wood frame bolding two sheets of glass between which two or three sheets of prange crepe paper have been pasted A 10 watt frosted bulb is fastened at the top of the compartment behind the window This small hulb also dimly lights up the storage compartment below through the three holes in the shelf and makes it easy to find articles in the storage compartment when working in a darkened room

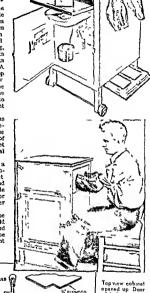
storage compartment contains shelves for bottles and equipment. The developing pans may be hung in slides at the ton of the compartment so as to be out of the way and yet easily accessible. A pocket can be provided on the door for additional

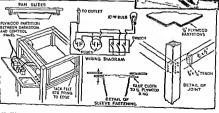
equipment magazines and books Underneath the storage compartment a

small shelf is provided for bolding the enlarging easel On the back of the cabinet a flat pocket holds the ferrotype sheets and also photo blotters A bar handle made from an old broom handle is provided for wheeling the cabinet which has 3" rubber wheels on the front legs

The outside is painted as desired. The inside of the storage compartment should be a light color for greater cleanliness and to aid in finding articles in the dark The enlarger is mounted in the most convenient manner on top of the cabinet.

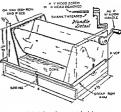






of darkrapm cam partment also acts as a shelf Nate enlarging easel pulled part ly aut af its shelf battom other phata shaws haw sleeves are used when load ing a developing fank on the ins de





The cloth belt's kept at etched by a sping that puls down the ends of the lower roller

### Print Straightener Takes Curl Out of Photos

To straighten prints most amateur photographers use makeshift methods It s however comparatively easy to construct a good print straightener

The one illustrated uses an endless cloth but that pulls the print under a revolving metal rod. The belt travels over four rollers three of them cut from broom handles 1 or more in diameter and the fourth a 1 metal rod fitted with wooden plugs in the ends to receive wood screws stream or the roll of the second servers and the roll of the second servers are the roll of the second servers and the second servers are the second servers and the second servers are the second servers and the second servers are the second servers and second servers are the second servers and second servers are the second servers and second servers are second servers and second servers are second servers.

A strap iron arm pivoted at one end ferests on the wood screw in the center of of the bottom roller and keeps some tens on in on the roller although allowing it to re

volve There is one of these arms at each end and they are jouned with a 15" wooden dowel A small coil spring draws the dowel toward the base of the straightener One of the two upper rollers is fitted with an old automobile window piece of toweling or other closely worse city that will not stratch appreciably

Prints should be run through the straightener as soon as they peel off the ferrotype plates If you desirs to straighten old prints hold them above a pan of boil ing water until they are moistened a little by the steam—STANLEY JOHNSON

#### RETOUCHING PRINTS, PART 3

[ PHOTOGRAPHY ]

Sepia and Toned Prints These are best spotted with oil or water colors since the color shades may be readily obtained by mixing

Etching Dark specks or small areas may be etched to a lighter tone with any razor edged blade. Use a very light scraping action and proceed care fully till the area being worked on matches the surrounding area.

Surface Luster Where etched areas on the print are noticeable due to the lack of luster a coating of muchage or gum dissolved in water will add the necessary gloss Gum from an envelope flap will do Experiment on the border of the print till the printture (when dry) matches the luster of the emilsion In water color retouch

ing the gum water can be mixed di rectly with the colors Permanence Dry spotting while

handier is not as permanent as either of the two wet methods since it will smudge more easily

POPULAR SC ENCE MONTHLY SHOP DATA F LE



### Four-Door Reflector Gives Perfect Light Control





THIS photographic lamp reflector has four doors so arranged that when they are partially closed a spot high effect may he obtained. Each door may he adjusted to screen light off from any area.

A sheet of aluminum at least 1/32 thick and 12" by 24" is sufficient for the reflector The one shown was made with only a few

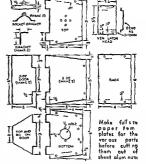
hand tools

It is best to prepare paper templates for all the parts before marking off the slummium Do all cutting and drilling be fore assembling the parts with ½. slumnum rivets In bending the various angles I used two lengths of angle Iron held to gether with two C clamps These acted as a vise

Two small pueces are cut as undeasted to form a collar or bracket for bolding the lamp socket. The binges for the doors are made by leaving protruding tabs and bending them around lengths of drill red. In this case. No. 48 drill rod was used. The ventilating holes drilled in the top are covered with a small light haffe.

Two pieces of aluminum rod 1" by 46" are bent and drilled to form brackets to support the lamp A short length of hrass tubing fits between them and is held with a carriage holt and wing nut

In obtaining the finish shown a small



wad of steel wool was applied with a circular motion to form a series of spots. If an etched or frosted finish is desired the alumnum sheet may be placed in a warm solution of caustic soda—Frank Caporael.



### Poper Clamp Supports Thermometer in Troy

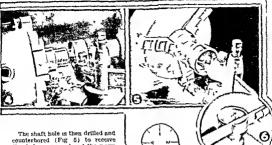
MANY amaieur photographers prefer plain glass thermometers but these are particularly difficult to use when testing the tempera ture of solutions that have aiready been poured into trays. One excellent way of supporting such a thermometer in a developing tray is to utilize a large spring paper clamp. All that is necessary is to enlarge the holes in the clamp slightly to fit the glass tube. The clamp rests on the table and against the rum of the tray but is not statched so the thermometer may be easily removed.—G. H



HHEAD cutting in a wide range of pitches and diameters can be done on a small screw cutting.

In the The coarses pitches require a number of cuts to the to complete the thread grove and in this operation to the coarse of the

and instructive project expensity as the work can all to done on the lattle inset? The indicator shown in Figs. 1, and 2 is made from cold rolled steel. The shell or body (Fig. 8) is turned from a solid bar as in Fig. 4 carefully smoothed with a fine file and polished bright with a strip of emery cold.



The shart note is usen formed and counterbored (Fig 5) to receive the d al on one end and the worm gear on the other Figure 6 shows a portion of the lower wall being cut away to allow the worm gear to mesh with the lead screw This opening was filed to shape with a large round file to fit snugly around the lead screw

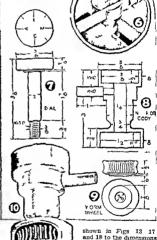
The hole for the supporting arm is being drilled in Fig 3 It is later tapped to receive the arm which is then made up and screwed tight

ly in place

The dial and its shaft are cut from a solid bar as shown in Fig 11 and brought to the dimensions in the drawings (Fig 7) The face of the dial is graduated in eight di visions four of which are num bered

These indicating lines can be engraved on the dial with a sharp pointed lathe tool laid on its side The dividing is done by a 32 tooth lathe gear slipped over the shaft. Use the lathe tool as a stop as il lustrated in Fig 12 The line is then engraved by drawing the pointed lathe tool across the face of the dial with the cross slide screw The work is advanced four teeth of the dividing gear again using the lathe tool as a stop and the operations re peated The four main divisions are numbered as shown in Fig 7 and an indicating mark is also stamped on the edge of the shell as shown in Fig 15

The worm wheel (Fig 9) has the follow ing diameters outer 1437" throat, 1353" pitch, 1273" For cutting the 32 teeth on the blank a dividing fixture is needed. In this case a suitable fixture was made as



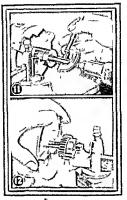
dividing (Fig. 18) and the gear blank was at tached on the other end

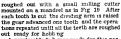
given in Fig 14 A 32

tooth lathe gear was

mounted on one end for

The fixture is clamped in a vise mounted on the cross side of the lathe. This is mounted at a slight angle to obtain the spiral in the gear teeth, which are then





A serviceable hob was made for this par ticular job from a 1/8 N F tap After be ing annealed this was turned smooth to 34" in d ameter and new Acme threads eight to the mich were cut as in Fig 20 exactly duplicating those on the lead screw of the lathe 'The new threads were then backed

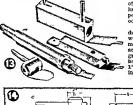
off for clearance with a fine file and the hob was rehardened and drawn

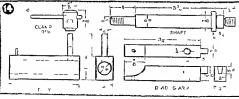
Figure 21 shows the hob mounted in the chuck and supported by the tailstock of the lathe The gear is mounted to revolve free ly It must be set at a slight angle (high on the left s de) for cutting the gear teeth spirally to fit the pitch of the lead screw The cross slide screw is used to feed the gear to the revolving hob which furnishes the motion to the gear as the teeth are being cut When the gear has been brought to the required d mensions so that it will mesh perfectly with the lead screw the vari ous parts can be assembled ready for use In cutting threads with the indicator each

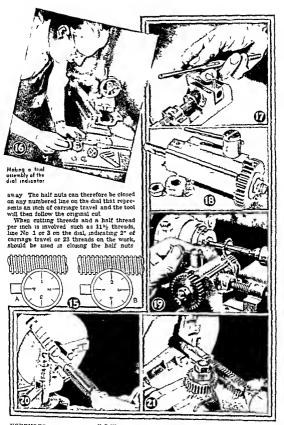
hne on the dial represents 14" of carriage travel so with all even numbered threads the half nuts on the lathe apron can be closed on any line on the disl For threads of an odd number close on any numbered line For threads involving a half thread per inch such as 1114 threads closs on any

odd numbered 1 ne

In cutting 11 threads per inch with the dial reading as at A in Fig 15 if the tool were withdrawn from the thread groove and moved back a distance equal to 4 or 5 lead acrew threads it would not fit into a thread groove in the work. However if it is drawn back 8 lead screw threads or a distance of 1" as shown at B this would bring the tool line with a thread groove 11 threads









### Oil Can Has Hook to Hang on Rung of Ladder

SERVICE men who are obliged to grease oil and adjust overhead machinery or pulle, a will find that a wire hook soldered on the oil can spout will allow the can to be supended from a rung of the ladder thus leaving both hands free when necessary



#### Soft Leather Case Contains Drills for Odd Jobs

BFCAUW he had often lost twist drills while on pion outset the shop one mechanic made a holder of thus soft leather as shown above to strap to hus portable drill. Individual pockets were sewed to fit each drill rather tightly A circular elastic band was sewed to the bottom to hold the pockets to the drill snugly while a second band cut in two and provided with a small snap button was fastened to the flay The bolder is so located on the drill body that the ventilating holes are not covered up.

### Slot in Socket Wrench Used for Tightening Wing Nuts

IF A SLOT about 1/4" wide and 1/4" deep is ground across the end of one of the larger heads of a socket wrench set, it forms a tool that will tighten or loosen wmg nut's or thumb screws. The mest stubborn wing nut may be turned with it and A narrower slot ground in one of the small wrench that and the same it easy to turn it easy to turn tightening de uices on radiation of the same in the same clamps to those clamps.



### Graph Paper Stuck on Square to Aid in Crosshatching

TO INSUE equally spaced lines when cross batching some part of a mechanical draw ing attach a piece of ordinary graph paper along the working edge of the Taquare with cellulose tape Adjust the perpendicular edge of the angle to each succeeding line of the graph paper—MASSIMINO RAINONE



Fine medium or coarse crasshatching is obtained by moving the triangle one two or three spaces



### Small, Deep Holes

AFTER drilling a large number of small deep holes in some castings a mechanic found that the quickest way to clean them out thoroughly was to use a pipe cleaner of the correct length in the chuck of a hand power grinder

### Magnetic Ground Contact for Carbon Welder

IN WEIDING or brazing large sheet metal boxes tanks and cylinders with a low volt age carbon contact welder I often ex persenced difficulty in getting a good ground return because the usual battery clip could not be applied readily at any point This was overcome by using a large horseshoe magnet from an old magneto

A wide copper strip was attached across the legs as shown below and the return wire was connected to one of the screws The powerful magnet holds the copper strlp firmly on any iron or steel surface flat or curved on which it is placed. If the magnet is not provided with mounting holes a C clamp can be used to hold both the strip and the return wire to the legs as the magnet is too hard to be drilled -W C W



### Half Hinge Holds Tubing While Being Sawed

To HOLD small copper tubing so that it can be sawed without being crushed one garage mechanic uses a half hinge placed in a vise as shown The tubing is inserted through the hinge pin boles. One of the looped ends acts as a rest for starting



The magnet holds the copper strp on the surface and assues a good ground



A LEEFUL little soft hammer for re moving kinks and dents in polished sur faces can be made in a few minutes from a 2" length of ordinary bar solder and a 10" metal rod The handle may be attached by threading the rod end and tapping out a hole in the center of the solder or by applying heat from a blow torch to the rod just above the solder and letting it sink slowly into the head as shown When the head has become badly battered it may be removed and used as solder and a new section sup

phed in its place



# File-Card

### KEEPS\_SHOP\_DATA\_HANDY

SINCE the introduction of the POPULAR SCIENCE MON-THAL Shop Data File many annatur craftsman are keeping by 5° filing cards. These require some type of file box and for those readers who take pride in owning the finest available shop equipment a special filing ease for the eards has just here designed.

The hox has three compartments for eards which wull hold as many as any reader will he lkely to accumulate for years to come The bottom of these compartments sinhis upward so that it is easer to find a eard. A wure rack is provided to keep in view the eard or eards he ig used and the eamer rack also holds a magazine open for ready reference against the open lid

When the lid is closed it forms a slant ing rest for small drawings or sketches or a magazine may be laid on it and held open by means of two wire clips which swing up from behind the lox. In addition these clips will hold several 3' by 5' cards upright.

The original filing case which was conetructed by Frank Hegemeyer a regular contributor to the department is a heautiful piece of eabinetwork. The drawings show how he made it but the box would of course be equally serviceable if merely mailed together with plain butt joints

Construction is begun with the front, back and sides of the lower part of the box (Fig. 1) The stock is surfaced four sides down to %; thick and 31, wide The top edge is shaped as in Fig. 3 while the bottom when the state of the state of the state of the wood bottom Out the front hack, and sides and mater the ends after when the eaw cuts can be made for the maple spines

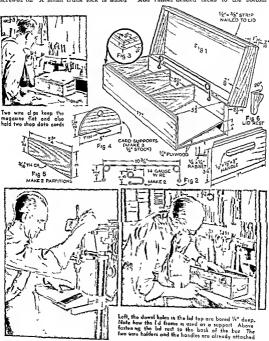


After gluing the lower part nail the hottom in place Make the two partitions (Fig. 5) of plywood or hardwood and nail to the false bottom

The entire hd is cut from 7/16° stock Fasten the ld top to the frame with 3/16° dowels The locations of the dowel holes are made to councide by driving small hrads in the top of frame and tapping the ld top on the hrad beads The handles are doweled and glued, and the hd rest (Fig 6) is screwed on A small truth lock is added

Card supports may be made as in Fig 4
The clips (Fig 2) are formed by bending
wire around a %" metal rod The inside
holder has a one and a quarter bend, and
the outside clips have two complete bends

Use a fine grade of sandpaper for the final sanding and if an open grained wood has been used, apply a paste filler Varnish or lacquer the box, rub down with fine purmee stone and polish with a rubbing campound. The linside can be stained later, Add rubber headed tacks to the bottom





CHAPER cutters are quickly set to any desired height above the table with this gauge, and it also serves as a straightedge for aligning

Cut a piece of 13/16" five ply stock and joint the edges. Set a wide cutter with the smallest available collar so as to clear the table 1/16", and cut full depth into the straightedge at the center This should be cautiously done, with a starting pin in use as for freehend work. With this indentation it is possible to align the fence with a collar, making use of this additional support at the point of cutting

Make the gauge indentations in steps of 1/32", ranging from 1/16" to %". In each case, try the setting first with a test cut in scrap stock. When the indentations are used with the bottome down, the height of the lower edge of the cutter is gauged, when turned over, the height of the top of the cutter is indicated. If paper labels are pasted on the faces to identify the gauges the cuts should be made after the labels are attached, so that the thickness of the paper will be taken into account Protect the gauge with lecquer or thin shelfac

#### FORGE WELDING, PART 2

#### I METAL WORKING 1

- 1 Do not use coal until it is thoroughly coked. A smoky fire is not a hot fire The fire should be a solid, white but mass of coals, above this body should be about 1" of blue fiame
- 2 The beginner always forces his blower too much. A low blast is preferable as it forces just enough air through the coal for the fire to consume Too much blast chills the iron rather than heats it.
- 3 Do not stick the pieces being welded too low in the fire. There should be at least 114" to 2" of live coals below the pieces being welded.
- 4 Never permit the pieces being welded to be exposed to the air while heating They should be covered with at least 14" of coals.
- 5 There is a tendency for the beginner to burn the metal A careful watch must be kept of the fire At the first sign of sparks or "stars" the pieces should be turned in the fire and then removed for welding

POPULAR SCIENCE MONTHLY SHOP DATA FILE

# Decorating Glass WITH A HAND GRINDER

Two tumblers filled with a dark bever age to show aff the designs in the glass to best odvantage

LASS working of various types is gaining popularity yanning manteurs. A very simple way to start is to grind designs inclinity into the glass with a small electric band grinder This is sometimes called painting on glass although color is not used of course

The process offers abundant opportunity for expressing artistic talent, but those who do not find it easy to originate designs of their own can copy or adapt pictures to be found in magazines and books

For your first attempts, all that you will require in the way of ma ternals are several cheap beverage glasses The grinding is done with small green silicon carbide abrasive wheels of various shapes

Plain frosting can be done readily with a wheel shaped like an oversize pencil eraser Mount the wheel in the chuck of your hand grinder and brung it into contact with the glass using short strokes such as you would make with a paintbrush Do not leave the wheel in contact with the glass try to paint with it In the beginning no attempt should be made to shape the work by grinding deeply After some practice, however, you will find it possible to carve the glass to any desired depth

You can learn to follow the lines very easily by purchasing a small



To frost a gloss hold the grinding tool lightly and use it to more short strokes as with a brush



Granding a design that was fused anto the glass. Below cutting I ees with a thin obrasive wheel



glass already dec orated with a colored design that is fused right onto the surface Care fully grind away the design on the glass which will leave the same de sign in an etched or ground finish which greatly in creases the value of the glass

Once you have mastered this method obtain a child s ten cent paint book and from it select a simple outline such as a duck or a goose Tear this out and fasten it inside the glass with adhesive tabe Then follow the outline on the out a de with a small round ahrasive wheel

If you make any errors they can usually be hidden by using a green rubber base abrasive wheel

You should have a dressing stone to keep the wheels in shape as they wear down Often it is cheaper to purchase fairly large wheels and keep them dressed to shape,

Right copy sig at deging attleded to the
mit do at the glass
mit de glass and per
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rather than to
wheels at the

rather than to buy very small wheels at the start. Some workers use a lubricant consisting of a small lump of camphor dissolved in several ounces of turpentine into which the wheels are dipped occasionally This is not necessary however with the very simple work just described.

With practice you will find that a variety of effects may be obtained by this method of grinding —KENNETH MURRAY

If you are exterested in glass working and would like other articles on this subject to be prepared for publication in later issues please send a post card to the Home and to thehop Department Mention any glass projects you would especially like to make

#### MODELING MATERIAL

The following formula for an inex pensive modeling material offers in limited possibilities to craftsmen design ers, and artists. A quantity if mixed dry may be kept in a dry place indefinitely Mix thoroughly two parts by measure

of asbestos paste (powder used for musulating botters steam ppes etc.) and one part Portland cement. When ready to use add use the musulating the pastern of the pastern of

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#### I FORMULAS I



bands or worked with modeling tools into book ends jars boxes bowls plaques and many other articles.

POPULAR SC ENCE MONTHLY SHOP DATA FILE

### Square-Headed Candlesticks



DY A UNIQUE but simple method a pair
of square headed candlesticks can be turned from one block of walnut Mount a block about 4 thick and 4% square in the



lathe and turn it as illustrated in Fig 1 Leave a ring around the center 1%" wide and 1/2" deep and undercut the sides as shown Turn the sides making them spherical and true and sand them smooth Remove the piece from the lathe

remount as in Fig 2 and cut off a part of the ring as indicated leaving a sec-tion 1%" square which will later become the candle socket. Note that these sides are also undercut Cut off the lower sides to

form a spherical shape and sandpaper well Now remount the block in the lathe as shown in Fig 3 and cut out a center section 5," wide Removing this section cuts the candiesticks apart. Each is then fastened in turn to the faceplate so that a %" tapered hole can be bored for the candle (Fig 4)

Sand the wood to a flawless surface and apply three thin coats of shellac rubbing them down between coats Glue felt on the bottom -BFNJAMIN NIFLAEN



g I Turn a rung the wide in the senter of the black undercut it and then found the sides



Ft 2 Change position of turning and cut off part of the ring leaving a section 1%" square



Fg 3 Remount the black and mark center sec wde Cut the off to gre two parts



Fig. 4 Attack each holder to the faceplate to a % topered hale can be bared for the candle



# -Alphabet-Soup

### FAST-SELLING NOVELTY AMONG



nall safety pass comented in the gloave





IGH SCHOOL students in various sections of the country have de veloped paying spare time busi nesses by making name pas of alphabet soup letters glued to wood bases The cost of materials is so low that the usual selling price of a dime a pin leaves a good margin of profit

The wooden blanks are cut from aromatic ted gedat welvogens or other untable. wood in long strips A good size is 3/16 thick and 12 or 5," wide A shallow groove is made lengthwise along the cepter line of one a de of each strip with a fine saw this is to receive an ord pary small safety pin The strips are then divided as required into the proper lengths. The cuts may be straight across at a 45-deg angle or curved After the front surface edges and ends

have been sanded smooth the safety pin

is fastened with quick-drying cellulose

cement a drop or two being sufficient Place the put so it can be opened easily Alphabet soup letters which can be purchased for ten cents or less in packages contain ng hundreds of pieces are glued to the front surface of the block with the same



A light rub an sandpaper evens up the letters

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# Name Pins

#### SCHOOLGIRLS

kind of cement. They should be applied in such a position that the safety pin can be inserted by holding it with the point to the left of the wearer. The letters may be staggered aligned carefully or arranged, nicknames school initials society names, nicknames school initials society names and the like Sharp pointed wesers are convenient for handling the letters and a shallow box containing compartments like a type case is handly for storing the letters when sorted. After the cement has set the letters are evened up by rubbing them on fine studypaper such as No. 60.

The dust caused by sanding is brushed off any surplus cement is removed with a lattle and the front and edges of the pin are given a coat of clear brushing lacquer. This further secures the letters to the wood and in the case of cedar brings out the grain and darkens the color to a beautilized Sometimes the letters are painted but the natural finish is generally regarded as more attractive. With reasonable care the plus last indefinitely—Roy, Exton.



So all act ve a e the p as they sell an salt



### A Pattern for Cutting Chinese Scrollwork

Tito't interested in scroll saw work will fait that an all over Chinese pat fern such as that aboun above is sadaptable to a great variety of projects several of which are elected. For use in garden furniture or out doors cut the panels from outdoor july ool. This type of design is also suitable for aheet metal grilles. The pattern can be enlarged to any de sired size by drawing squares and copylog the outline through them.



### Colorful Little Serving Tray Shaped Like a Duck

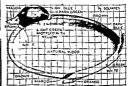
Cur out in the general form of a duck this colorful little serving tray which can also be used as a nut bowl may be made by any craftsman who has a scroll saw and equipment for routing. The original de

signed by members of the Metropolitan Jumor Achievement New York is shaped from a block of birch about 1½" by 7" by 10" The general outline is first scroll sawed

The general outline is first scroll sawed then the unterior is routed on a drill press The tail head beak and feet are shaped with knife and sandpaper. These parts as well as the upper edge of the

tray are painted but first the whole may be given a protec tive coat of clear lacquer if de sired This project makes an attrac tive gift and also sells readily

CLOCKED PROJECT Average T me 4/2 bou s



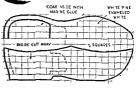
### Dutch-Shoe Flowerpot Holds Two Tulip Bulbs

A BLOCK of acft white pine 3" by 5" by 8" is used for making this Dutch shoe flower-pot for tullp bulbs. Draw the outline on the

The shoe is shaped on the band saw and completed with a drawin fe and a place

wood and remove the excess with a band saw In the heel bollow out a space as shown so as to provide room for two bulbs Work the outside down with

a drawknife and block plane Sandpaper well and give the inside of the heel two or three coats of so called C quality marine give The outside may be enameled white and trimmed with blue or some other clear attractive color



# **Etched Sundial**



IN BRASS OR COPPER

EITHER brass or copper may be used for making this sundial It is laid out to register approximately correct time anywhere from latitude 25 to 50 deg north which includes

all of the United States as well as part of Canada and Mexico Most sundials are made of brass but for those

who like an antique green finish copper is better because when exposed to the elements it will take on a natural verd green surface quicker than brass.

Lay out the dial on paper as shown Cut out a disk of the metal to be used-14 gauge is heavy enough Lay the pattern over the metal place a ebeet of carbon peper between and with a hard pencil trace the face of the dial on the metal

Remove the pattern and use a fine brush to peint the numerals and lines on the metal with sephaltum vernish. Be very careful to get straight. even lines. If any lines are not perfect finish the iob and let it dry hard then scrape away the excess asphaltum

Lay the dial on a perfectly level surface and build a fence around it with putty peraffin or modeling clay It must be leakproof. To about one third teacupful of water add very slowly and cautiously a like amount of commercial nitric acid. Pour this carefully over the dial and let it etch until the acid stops working Then add a little clear nitric acid Continue adding soid from time to time and

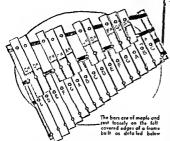
the acid to come in contact with hands or With the metal at a temperature of around 60 deg the eich should reach a depth of about 0 005" in one hour Pour the acid out

Wash well remove the asphaltum with kero sene or lacquer thinner and polish the piece

The style or guomon for casting the shadon is cut from the same material and riveted in place as shown with brass escutcheon pins If a polished finish is desired coat the sur face evenly with thin white shellac -D H

The dal is mounted on gay gppro priote type pedestal rock the piece occasionally so as to insure even etching Do not allow A fence of model na clay is bult around the dal and acid poured on the metal in order to efch if

#### AN FASILY PLAYED MUSICAL INSTRUMENT ANY CAN WOODWORKER RUILD



### TWO-OCTAVE CHROMATIC

that it serves as a good in troduction to the study of the piano since the piano keyboard is laid out in ex actly the same way Provided it is tuned to standard pitch it can be played with other instruments or with a

piano accompaniment The frame may be of pine or whitewood Cut the pieces to the given dimensions place them as shown groove the shoes 1/4" deep to receive the stretchers and fasten with glue and brads Then block plane the ends of the stretch ers to suit the ends of the frame Stain the frame any desired color and glue a %"

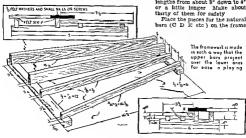
wide strip of thin felt on the top edge of each stretcher

Make the bars a full 5," by %" to allow for smoothing Fourteen lineal feet will be required to allow for spoiling some in tun ing They should be of thoroughly seasoned hard maple of as nearly uniform texture as possible with the upper corners slightly rounded as indicated Cut them in graded

lengths from about 8" down to 4"

XYLOPHONE is one of the sumplest musical instrumenta to construct The cost is trifling yet the finished instrument if accurately tuned will be quite as good as those sold in music

stores The tone of a xylophone is soft and pleasant Even children can learn to play it without difficulty. One valuable feature is





so they just clear the 1" stretcher as at X Mark the line of the center of stretcher Y on the bars and drill a %" bole through the center of each bar In the case of the sharp and flat bars (C sharp, D sharp, F sharp, etc) simply drill a %" bole through them 1" from the end as shown

Place all the bars in position, center and drill a small hole in the stretchers for each har, and drive a temporary brad through the hole in the bar into that in the stretcher to hold it

Two mallets must now be made The beads are turned wooden balls %" or "s" in diameter Fit a 3/16" rattan handle 9" long into each and give it in place



In tuning, strike the longest (C) har with a mallet and compare its tone with that of C one octave above middle C on a piano Tune the Cs, Es, and Gs first, then the bars between Tune the sharp has by the tones of the natural bars above and below them To raise the tone of a bar, saw a little off one end of it to lower the tone, make a shallow saw cut in the back of the bar Avoid the latter if possible, for it deaders the tone

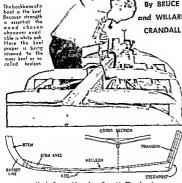
Blacken the sharp bars as shown While these are customarily marked C sharp D sharp etc, it is understood of course, that C sharp is also D flat, and so on

Make felt washers 3," in diameter and drive a very thin, loosely fitting 7s screw or an ornamental upholstery nail to fasten each bar permanently Be sure the bar is not beld rigidly, or vibration will be restricted The writer merely used cut off threepenny finishing nails in making the xylophone shown in the photograph. Straighten the bars until they are all parallel then drill small boles in the other stretchers between each pair Drive screwa or nails with felt wasbers under the beada to separate the bars and keep them aligned These screws or haila also must be arranged so as not to prevent the free vibration of the Place four rubber headed nails under the corners of the frame to serve as feet

### How to Reglue Chair Joints So They Won't Come Apar?

THE amateur craftsman who tries to mend a chair by driving nails through the legs into the rounds or rungs is piling up trouble for himself Not only are the joints likely to loosen soon after the chair is placed in use, but when permanent repairs are necessary, the nails may make it im-Passible to take the chair apart without breaking it Screws bold better than nails, but any method of repairing a chair short of taking it apart, cleaning off the old glue. and regluing throughout will not be efficient. This work should be done during dry weather or when the chair rounds are well shrunken by artificial heat. The rounds should also be heated before gluing, other-Wise they may shrink in time and break the film of glue When the joints fit very poorly, use metal chair-round fasteners

Keel Construction



Keel Assembly of a Small Rowboat

N MOST small boats the keel serves

Another type of construction calls for a fairly deep teel. One end of the keel is spliced to the stem the other end is fastened to the stempost

several purposes It acts as a rub strip to protect the planking from damage, aids in keeping the boat on a straight course, and at the same time is usually the most important longitudinal member from the standpoint of strength In large hoats and in all round hottom boats the keel is virtually the backbone it supports the ribs stem and transom and takes most of the stresses to which the boat is subjected In many modern small V bottom and flat hottom hoats however. the importance of the keel is greatly reduced because the chines batters, and planking take up most of the fore-andaft strains

Keels fall into two general classifications—deep keels that are sawed to shape and flat keels that & sut into position along the curve of the high line Because of its

strength white oak is almost always the best material to use for a keel except in a few localities where water conditions make it impractical.

In order to prevent leaks between the keel and the bottom plank next to it, that is the garboard plank a rabbet is either cut the full length of the keel, connecting with the stem rabbet, or an inside keel is used to serve the same purpose The inside keel goes by various names such as keelson, spron, keel bat-

ten of lay board
This keelson is
screwed, boiled, or
riveted to the keel
and is always sufficiently wider than
the keel to provide
plenty of bearing
surface for fastening
down the gerboard
plank The twopiece keel thus

practical for most small boats, not only because it saves the work of cutting the rabbet, but because two pieces are much more easily bent into position than one Except where the bottom of the boat is flat, the surface of the keetson must be bevied so that the garboard plank will fin against it perfectly. The better the two surfaces fit, the less chance there is of a leak.

The keel on a cross planked fiat-bottom boat is usually only a flat board fastened to the planking, either on the outside or inside, and its principal function is to prevent leaks by holding the planks in position. In fast boats of the hydroplane type, the outside keel is usually omitted altogether, to reduce friction

At the bow, the stem and stem knee are usually boiled and screwed to the keel, and at the stem, the transom and transom knee are fastened in the same way All

# for Boat Builders

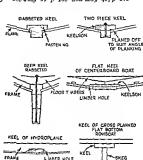
such bolts should be a driven fit with the nots on the inside and the heads countersunk on the outside so that they can be covered with plastic or with a wood plug soaked in paint or marine glue

On small boats with a flat keel there may be added a skeg toward the stern The skeg often takes the place of a deeper keel in helping to maintain a straight course while rowing. In large inboard boats a similar addition to the keel is known as deadwood it protects the shaft and propeller The skeg or dead wood is fastened to the keel proper with long holts or galvanized rod or in very small boats with screws only

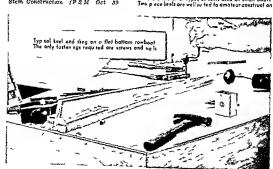
An upright piece at the end of the keel skeg or deadwood called a stern post is used in many types of boats to brace the skeg or with an inboard as a point of attachment for the stern hearing

The subject of next months article 13 the use of resin bonded marine plu wood which is the greatest single con tribution yst made to help amateurs build better boats. This series of articles. on small boat construction is intended to supplement the plans presented from time to time for POPULAR SCIENCE boats The subjects so far covered are Stem Construction (PSM Oct 39

175), "Reading Boat Blueprints' (Nov 29 p 203) 'Boat Planking Hints' (Dec '19, p 174), Setting Up the Frame' (Jan '40, p 194), and 'Replanking a Flat Bot tomed Rowboat (Oct '40 p 183) For sails, see July 39 p 160 and May 40, p 176



Here are the ch of types of keels used on small boats





#### molding and the rods are supported by in sorting their tips in the slots which must be cut to suit the diameters—W SCHEDLEAUER Bolt Adjusts Slope of Level

To ADJIST his spirit level for determining the alope of cement walks one contractor uses a bott and thumb nut. It is fastened beneath the level at any point necessary to give the required angle. In this way the forms are quickly and accurately adjusted



## Section of Old Auto Cosing Serves as Gate Latch

This practical latch for a farm gate may be made by cutting a notch in one sade of a short section of a discarded auto casing and nailing it may be top of the gatepost as illustrated below—G E H



Method of cutting pece of the cas and attaching that a feace post

## Hanger on Woll Keeps o Shovel Out of the Way

ANOTHER use for an old true causing vs as a holder for showels and similar tools Cut a sect on 6 long and with a sharp kinite make a slot about 2½ long in each of the side walls Nail this section on the wall with the slot openings facing upward Piace the blade of the showel in the slots — S LOMEN = S LOMEN =



## Soldering Copper Kept Hot for Work in Cold Weother

SOLDERING outside in cold or rainy weathcross that make the continued heating of the
soldering copper almost impossible in such
cases, heat the copper inside some nearby
building to a slightly greater degree than
usual and plunge it into a tin can filled with
ashes, sand, or dry earth. It can then be
carried to the work without



## Plonts Protected from Frost by Self-Anchoring Covers

Rocks or other weights are not needed to hold tin cans over small plants for protection from frost if the open ends of the cans are clipped to provide

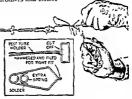


are clipped to provide a serrate edge A mere tap on top of the can will drive it into the soil If the admission of some air to the plant is desired do not force the teeth of the cans all the way into the ground.

# ESTENDED SPACES SEEP MOSS REP MOSS FEEDING FEEDING

## Long Bors Across Hog Trough Prevent Fighting ot Meols

ENLEGING upon the idea of placing dividers in hog troughs to prevent fighting at meal times, some stockmen have gone further and extended the spacers so that each anmal is confined to his own section and camnot crowd sidewise to shut out his hungry brothers and sisters



## Test-Tube Holder Converted into Fly-Tying Pliers

To THE first expertly, it is necessary to have a good pair of hackle pliers. These can be made from a wire test-tube holder, obtainable from any chemical supply house for about ten cents. Cut off the holder where indicated then hammer and file the ends to fit smoothly and tightly together. To increase the tension, an extra spring is then added as shown—LEENY NOYES.

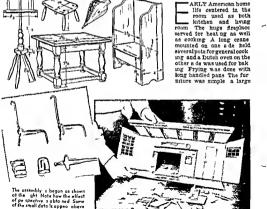
## Oiled-Silk Caps for Oilstove Burners

Oilstoves, especially those used in summer kitchens, cabins, or camps, are often left unused for long periods, during which they may become very dusty As a result, they burn poorly when first lighted, filling the room with smoke

This difficulty can be prevented by slipping oiled silk covers over the top of the burners when they are not being used The covers will prevent water, dust, and food particles from falling on the kindlers, thus keeping them clean for instant use—E. H.







## Colonial Kitchen

## TO MATCH THIS BEAUTIFUL MODEL IN OUR NEW DIORAMA CONSTRUCTION KIT

table slat back chairs and a settle were the main pieces The soft illumination of candle racks and wall brackets supple mented the firelight at night

To recreate this picturesque scene in miniature takes but a few hours with a new merpensive construction kit Popular SCIENCE MONTHLY is offering to those of its readers who wish to take up the bobby of building small dioramas as outlined in the article Scenes in Ministure lished last month (PSM, Oct 40 p 198)

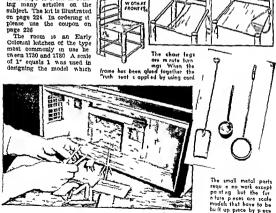
The complete kit with detailed instruc tions and drawings costs only two dollars It will insure the success and artistic quality of your first attempt at this work and also

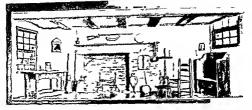
teach you more about the construction of realistic and beautiful dioramas than you could hope to learn in read ing many articles on the subject. The kit is illustrated on page 224 In ordering it please use the coupon on

is about 21" long 7" high and 5" deep Walls floor ceiling and fireplace are printed in four colors on heavy cardboard All flat parts of the furniture have been marked on plywood and can easily be cut out The turned parts come already shaped Such accessories as the metal pans and trons and shovel are die cast and require merely to be painted

Erecting the model is a pastime the entire family can enjoy Father and son can cut out and assemble the furniture Mother and daughter can help install the fixtures as well as crochet tiny rugs for the floor and make curtains for the windows

The first step is to fold the room into





Constructed on a scale of 1 equals 1 the model s approximately 21 long 7 high and 5 deep

shape and glue the flaps where sections must be joined. Then install the frost beam A framework of wood may be added to give additional strength, if desired but the room will remain rigid if the flaps are glued securely.

Now my may the first parts of the furniture to shape and cut the dowels to the correct lengths Drill 3/32" bokes as in dicated on the drawings accompanying the kit Sand all pieces with 3/9 paper. Rulo on the wax finish and polish with a soft cloth being careful no wix is applied to surfaces to be glued. Two applications are sufficient Assemble the pieces with glue.

An imitation rush bottom can be green the chair by winding cord around the front and back rails then weaving it sideways with the aid of a needle as shown Candles are made from round toothpicks about 1/2" long Dip them in white enamel and before it dries place about 1/2" of black thread on the top of each for a rick

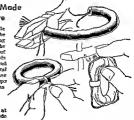
Old sandpaper forms the flexible part of the bellows Scrape off the sand cit a piece about ½" by 3" and fold and give it between the two wooden sides Heavy black thread binds the sides and nozzle (piece of dowel) logether Coat with shellar

Give the chromium plated mirror to the back of the printed cardiopard frame and insert a short string through the top for hanging Give the transparent cellulose sheets on the outside of the windows Frates the rule and powder from above the mantelpiece with thin wire Paint andirons showed tongs crunk herlie and pans black showed tongs crunk herlie and pans that of Give the freplace to the back of the room and arranger the furnitum and utensits

#### Small Ship-Model Life Buays Made from Rubber-Covered Wire

IEEE backs for model asign may be made from flenther rubber covered war of the correct scale in the costs leaving sufficient hands and the costs leaving sufficient faultation and the correct scale and cost away all but two strands are war at each end. Then brings the two estimates around twist the wives together and brade into a loop. For the tope twint several strands of écric colored salk thread together and fasten on the budy with narrow stripps of addressive tape. Paint the completed as sembly white PAIL H. SITE.

SMALL model parts can often be found at a ten-cent jewelry counter. These include chains and accretimes even good anchors





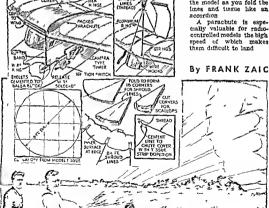
## Gas-Model Plane Parachute INSURES CRASHPROOF LANDINGS

EPE is an automatic paracoute at tachment for lowering a gas model plane safely to the ground It was desyracuse (N Y ) Model Airplane Club
As soon as the motor stops a timer re leases a rubber band which in turn releases the aluminum flap under which the 'chute is packed. The wind pressure blows the flap back, and the chute pops out and up

to unfold and bring the model down gently The chute weighs about 7 oz and is large enough to support 3 lb or more It is

folded for use in the same way in which it is prepared for scallop-Have an assistant hold it up and away from the model as you fold the lines and tissue like an

> cially valuable for radiocontrolled models the bigh speed of which makes them difficult to land



# HOW MUSIC COMES



Homemade Siren Produces Musical Tone

punched in a motor-driven tin disk. Irregularly spaced holes will give only a confused noise Evenly spaced holes emit a musical tone whose pitch depends on the spacing and motor speed

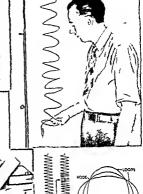
#### Weighted Wire Shows How String Instruments Work

FASTEN a steel wire at one end, and weight the other after passing it over a pulley mus cal pitch when bowed or plucked may be raised by in creasing the tens on shortening the string or substitut ing a thinner wire

# FROM SOUND WAVES

## Coil Spring Illustrates Sound Waves

WHAT we hear as sound is a succession of waves of compression and rarefaction pas sing through the air from the source to the ear A simple weighted spring demonstrates this mechanically Squeeze together two or three of the lower turns and then release the spring A wave of compression will travel up and down the spring until the original energy has all been expended One of the small diagrams below the photograph illustrates the movement of the wave along the spring



# Easy Test for Sound-Reflecting Qualities

To TEST the sound absorbing or reflecting properties of various materials place a watch in an open cardboard tube insulated from a table with cloth or cotton Set a cardboard sheet at a forty five degree angle near by Listen through a tube as shown Bits of cloth laid over the card board will diminish the loudness

#### Goblet Vibrates Just Like a Ringing Bell

WHEN a bell is struck by its clapper its rim is distorted into an elliptical shape from which it springs back through the circular to another ellipse with its longer axis at right angles to the first. You can see this action by suspending four glass marbles in contact with the outside of a gobjet and striking the inside with a pencil



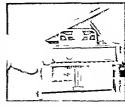
## WHAT'S NEW IN THE

## Signal Tracer Quickly Locates Troubles in Receivers

CONTAINING a vacuum tube and volume control a new s gnal tracer du ckly locates the seat of frouble anywhere in a rad o rece er All servicing tests are said to be

er All servicing tests are said to be
poss ble with the unit. The tester
is connected to the errut, and
the set is turned on. A test prod
at one end then locates the
trouble when the tester causes



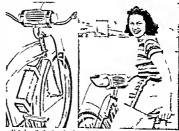


## Table-Model Set Masquerades As Midget Grand Piano

AN ATTRACTIVE min attire of a grand pano recently introduced houses a migher radio race wer. As shown above the tuning knob and switch are on the panel directly above the 'Rejboard,' while the speaker grille and tuning dal are below The s greature of the treble clef decorates the speaker grille of the receiver

## Loudspeaker Radio for Bikes Rides on the Handlebars

WITH a new battery set des gned to fit atop the handlebars b cycle enthus asts may now I sten to their favorite programs no matter where they happen to be pedaling As shown in the illustrations at the right, the set has convenient tuning and volume knobs at the s des and a separate battery box that clamps to the bicycle frame An antenna attaches to the tip of the front fender and curves back to the set. The three tube rece ver the loud speaker of which faces the rider measures only 3 .. " by 41. " by 8".

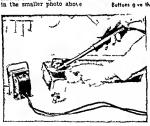


now the loudspeaker faces the rider on this new bicycle radio se

# WORLD OF RADIO



perions give me received and received and received



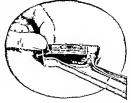
are conveniently grouped at one side of the timing dial as shown

## New Lightweight Soldering Iron

When heating elements and heavy tips for hold ing the heat are eliminated in a new soldering from for radio-set builders. The tip contains a special carbon electrode element that is said to bring it to soldering temperature in less than a mante Power regulated by a come nient thumb switch is fed through a compact transformer

## Phonograph Crystal Unit, Like Coffee, Now Dated

Jist as coffee companies milk dis tributors and others date their products to show their freshiess a maker of crystal units for electric phonograph pick ups is now dating his products. Purchasers can thus tell at a glance just when the crystal unit was assembled



## One-Tube Set Gives

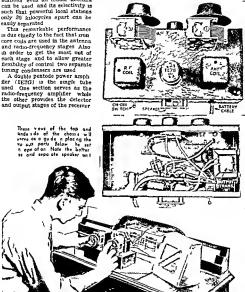
TTHOUT the use of a tricky reflex circuit or hard to get parts this one tube tuned radio frequency set will give full loudspeaker results on all local stations when a good outdoor antenna is used Within ten miles of local stations even an indoor antenna can be used and its selectivity is

only 30 kilocycles spart can be

easily separated

This remarkable performance is due chiefly to the fact that iron core coils are used in the antenna and radio-frequency stages Also in order to get the most out of each stage and to allow greater flexibility of control two separate tuning condensers are used

A double pentode power amph fier (IE7G) is the single tube used One section serves as the radio-frequency amplifier while the other provides the detector and output stages of the receiver Grid leak detection is used on the second tube and its plate is connected directly to the speaker without any additional audiofrequency amplification. Sufficient power is obtained with this hook up to work a 6"



## **Loudspeaker Volume**

speaker without the use of any regeneration In wiring the set care must be taken to

In wrining the set care must be taken to connect the positive lead of the 'A' battery, and not the minus, as is usually done, to the sakes it is an important point as the set will not operate properly if the A leads are reversed A double-pole single throw switch serves to break both the A and 'R supplies and can be mounted on the rear of the chassis The switch can be either the toggle or rotary type

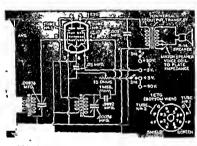
The speaker is separate from the chassis and is mounted in s wall type haffle similar to those used in public address paging systems. The baffle has a sloping from desired to take a 6 speaker. The universal

output transformer, necessary for matching the voice coil of the speaker to the load resistance of the tube (or plate impedance, as it is sometimes called), can be mounted under the receiver chassis. The load resistance of each section of the IETG is 16,000 ohms and an instruction sheet inclosed with each transformer will indicate the taps to use to match the speaker to that load resistance. The taps are placed on the secondary winding of the transformer.

When wring the 15-ohm rheostat, which serves as a volume control by decreasing the filament voltage, be sure to connect the resistance winding to the 3-volt battery Many times the moving arm is connected

internally to the shaft and if this is the case it will be grounded automatically to the chassis In cases where the arm is insulated, it will not make any difference which way the rheo-

stat is wired
Since this 15-ohm
variable resistance also serves to cut down
the 3-voit 'A hattery
supply to the 2-voit
maximum required by
the filament of the
tube, a mark should
be made on the front
panel just above the
rheostat knob to indicate the safe 2-voit
himit beyond which the



With only one tube the circuit wiring is easy even for a beginner



The knobs used on the original receiver have no set screws. A nut, concealed under a removable cap holds each on its shoft. The photo of the right shows how the loudspeaker is connected



Three new-style botteries are used to power the receiver. The plug in type connectors save time

rheostat knob should never under any circumstances be turned In tuning the set remember that both

tuning condensers must be operated. The two readings will be just about the same, provided the dails are mounted on their smarts in the same relation As a matter of fact these two condensers can be ganged if desired but the double coupled does provide greater flexibility and makes it pos subte to make mipor adjustment is n any one condenser in order that maximum volume may be obtained.

No ground is necessary with the circuit, and as pointed out earlier the type of antenna, indoor or outdoor, will depend entirely on your geographical location with respect to strong local stations

## LIST OF PARTS Shielded antenna coil, iron-core

Shielded RF coil, iron-core Condensers, tuning, two, 00036 mfd. Condenser, tubular, paper, 05 mfd., 600 v

Condenser, tubular, paper, 005 mfd, 600 v Condenser, mica, 0002 mfd

Resistor, carbon, 1 meg, 1/2 watt. Rheostat, 15 ohms 4 watts Miscellaneous Tube (1E7G), octal

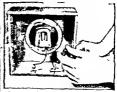
wafer socket, universal output transformer, chassis (2½" by 5" by 9½"), cabinet (4½" by 7½" by 8½"), two dials, DP ST toggie switch, two 45-volt "B" batterles, one 3 volt "A" battery, PM speaker, wire, soider, etc

# Get Started Radio

Y ADDING a half-dozen parts to the all-electric receiver described last month as pert of this series, you can provide a final stage of amplification For this stage, the power pentode in the 70L7GT tube is used, end with this additional power there will be sufficient volume to operate a loudspeaker The speaker, included in the original list of parts (PSM, Sept. '40, p 196), is a 5" magnetic unit which can be mounted in s small homemade wooden cabinet. If you do not wish to go to the trouble of making up e special cabinet, the speaker can be mounted on a small baffle about a foot square Two Fahnestock clips can be used to connect the speaker to the set. These are mounted just inside the cabi-

#### ADDITIONAL PARTS

Mica condenser, 002 mfd Electrolytic condenser, 10 mfd. Fixed resistor, 150 000 ohm Fixed resistor, 1 megohm. Fixed resistor, 600 ohm Loudspeaker



Two epring of ps serve as speaker connectors

## PART III . . . A FOUR-TUBE RECEIVER

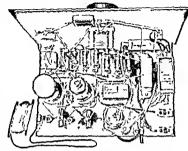
net, along the bottom (see photo)

The additional parts required from the original parts list are one 1,002-mtd mica condenser, one 10-mtd electrolytic condenser, and three fixed resistors (150 000 ohm, 1 merohm, and 600 ohm)

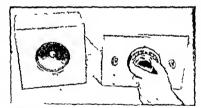
When making the various changes, note that some fixed resistors used originally have been lurgled around a bit For instance, the 200 000-ohm resistor used in the plate circuit of the three-tube circuit has been replaced by a 150 000ohm resistor and the 200.000-ohm resistor used in the grid circuit of the power pentode (70L7GT). The original 006-mfd tubular condenser is used this time as a bypass condenser between the plate of the triods (25BSGT) and the ground (or chaesis) No ground connection is Deeded with this

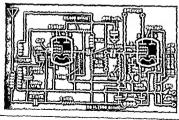
'four-tube" elecuit

Any type of antenna
may be used



The circuit as it appears wired as a four tube' receiver. The antenna wire is coiled at the left. The clips at the right are for the speaker





In wiring the circuit be sure to follow the diogram curefully. The new portion of the circuit is indicated by the heavy tines. Socket connections are shown below



When it is not in use the stamp pad is kept closed by turn ng a screw eye

## Stamp Pad Nailed on Wall Above Shipping Bench

A SHIPPING clerk keeps his stamp pad handy and prevents others from borrowing it hy tacking it on the wall above his work hench as shown A screw eye serves as a turn button to hold the box closed

## Spring Clothespins Changed into Soldering Clamps

SPRING clamps for bolding small metal parts that are to be soldered or brazed can be made from ordinary wooden clothespins For the type shown at A, clamp a clothespin in a vise so that the



raws well remain in line and drill a hole slightly smaller than the roundhead screws to be used. After the screws have been inseried, pass a thin file between the points to flatten them

Clamp B is used where very small pieces are to be held for soldering It consists of two pieces of wood shaped as shown to take the spring from a spring clothespin The metal jaws are two nails One is flattened on the end and the other is left pointed -J A A

TO IMITATE frosting on glass mix 6 oz epsom salts in 20 oz warm water and add 2 oz white dextrme, then apply to the glass

## Copper Strip Improves Soldering Iron

SOME electric soldering irons have beating elements considerably smaller than the casing. An iron of this type will heat more rapidly and be more efficient if a strip of sheet copper is wedged between the element and the casing so as to bring them into firm contact -G S G



#### REPLACING CANE WEBBING IN CHAIR ISHIPSHAPE HOME!

With hammer and chief remove spline bolding old cane in place. Clean out groove thoroughly with chisel but be careful not to chip wood

Prepare four or five wooden wedges tapering from " to " in thickness and about 1" wide Select spine that fits loosely in groove and cut to correct length with a lap of at least 1/4" which can be trimmed later Soak woven cane wabbling in water from one half to one hour until pliable then lay on seat and trim to exact shape allowing % additional around the entire piece. Make certain front

of seat is parallel with strands of webbling

Drive webbing into groove and hold with wedges first at back then in front and finally at sides. Term off excess webbing with third around outer edge in bottom of groove Pour glue (preferably hot cahmetmaker a glue) into groove and insert spline. If spline is stiff first steam it or soak in hot water until pliable Drive spline into place with rawhide mallet or use soft wood to project it from being marred Remove excess glue with wet cloth and let glue set for at least 24 hours

If seat is not tight after drying wet the underside with water and place in sun or near radiator or furnace

FORUSAR SCIENCE MONTHLY SHOP DATA FILE



TONIGHT make a picture taking date with the whole family And for surer results in your snapshots at night under Photofioods load with Kodak Super XX about four times as fast as ordi Film nary film You can then from the very first count on indoor snapshots at night that are as clear and brilliant as those you have been getting outdoors in the sun

And your camera doesn t have to be an expensive one either Any camera that a \$1 Baby Brownie

- le Kedak Haedy Reflectors
- A few meutes with this helpful backlet and yours headed for splend d a ghttime snapshots. Photos d ag ams easy lo-understand directions. At your dealer's Eastman Kadak Company Rocheste N Y

takes Kodak Super XX Film will do even Load your present came a with Kodak Super-XX Firm Use a couple of nexpent ve Mazda Photoficed lamps Follow the few smple directions in the FREE Bookfet

NIGHT SNAPSHOTS simple as ABC with

KODAK SUPER-XX



Have you heard about these

# New Willard Products?



## WILLARD ANTI-FREEZE

Highly effective —three quarts are equivalent to approximately four quarts af and nary alcohol Contoins a special anti-rest ling-edient that protects the coaling system.

WILLARD DRY CELLS

Built to the same rig d spec fications for which Willard is famous. Try the new sturdy, streamlined Willard Flesh lights and the new Willard Dry Batteries built to last langer!



## HINTS ON BATTERY CARE

tuns batteries



Winter starting failures are often the result of injuries your bottery received duringhat weather

ceived duringhot weather
theat speeds up the chemical action of your battery
couses the water to evoporate more republy
lacreages the danger of buckled plates and
chaired insulatus. Let your Williago Deeler
make sure that the "wear and teor" of summer
during has it harmed your battery—see his NOW,

SEE OPPOSITE PAGE..

# Willard

YOUR ASSURANCE OF QUALITY



## Draft Deflector Is Wedged Between Window Jambs

Will's a board is used to deflect the direct draft from a partly opened window, you can fasten it securely in place and also remove it wetnout the last difficulty by tacking a length of rubber hose to each end as shown. The shelfd will then wedge firmly between the window jambs on each side and stay at any dearred angle.

## Old Fountain Pen Contains Handy Razor-Blade Knife

FROM an old fountain pen and a raporblade, I improvised a kinds that could be carried safely in a pocket and used for cutting chaptings Discard the pen point. Spids at "length of lead pencil lengthwise and remove the lead Place a narrow razor blade between the two halves and bind with sufficient cellulose tage to insure a tight fit in the hole from which the pen point was removed. About "of blade projects — MK.



# "Have you heard about the New SAFETY-FILL Willards?



#### LONGER LIFE 10-15% more miles and months

These neu Willards are the finest bat

teries we have ever built' They give you 10 to 15% longer average life ...even longer than former Willards . . . ot no extra cost.



## MORE RESERVE POWER

Active materials increased 7-9%

All of these new Wellards are built with either thicker plates, bigger plates or more plates Result -you get longer life plus plenty of reserve power for lights radio heater, other accessories-and winter starting

## GUARANTEED CAPACITIES

You know what you're getting

Every Willard has its guaranteed ambere hout capacity molded in the case You can see exactly what you're gening And you pay only for what you get Look for this guarantee of full

measure of battery value

"Safety-Fill" Stops dongerous corresion

"Safety Fill" is no exclusive

PLUS-

Willard device that prevents overfilling-guards against acid spray on wiring and motor parts it protects your car against corroded cables and terminals that cause current losses and unexpected statting faslures

lour Willard dealer has a fresh stock of these "More-for-your Money" har teries now Look for his red and white Willard sign or the name Willard in the classified section of one book under Barrenes. WILLARD STORAGE BATTERY CO Cleveland . Dallas . Los Angeles . Toronto

# SAFETY-FILL BATTERIES

BATTERY MONEY



#### Others know there's no tobacco on earth that equals this truly AROMATIC pipe mixture

Some people don't like anything new Here's such a new different smoking experience that some men don't like it. But thousands won't touch any tobacco but Bond Street.

Bond Streets like expensive custom blends in flavor fragrance bite free cool ness Contains rare aromatic tobacco never before used in a popular price mixture

Even wom en approve its aroma

In fauness to yourself get a 15¢ bn —today!



Todoy-try o tin of

# BOND STREET

A Product of PHILIP MORRIS

Please ment on Propular Science Monthly when w i mg to advert sers



## Old Bill says

A STEEL plate with a substantial layout of tapped holes is a convenience when bolted to the table of a drill press. The holes save time in clomping work.

It takes a good torch mechanic to cut carbon or high speed steet toithout scorching but it takes nothing short of an expert to hold a perpendicular cut in stoch over 4" thich

Rather than take the time to bore a hole ac curately in stork held in a three yaw chuck so us to remose 0002" from a 2" hole in a hardened sleeve havent only a 002" will soldered the part lightly to a 1 cut angle plate and trued the assembly concentrically on the lathe faceplate

Bores in A I die castings are usually to tize but if they are slightly undersize a hordened and relatively ground burnish ng bar pressed through uill produce the required size and give a high fainth to the bore

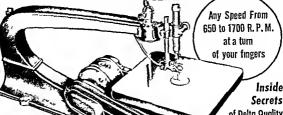
If you can't afford regular contour saturing equipment metal band saws are so reasonably priced that you can save the slug without indous drilling and chipping to derive an internal ait him. Drill holes to clear all corners cut the saw pass one end through a hole weld the saw and go to work him.

Judging from my own observation I believe that a mon with avernge intelligence con learn more in a week if he stands by a highly experienced mechine hand and asks questions than he will in fear at one of the training sessions num popping ap oversywhere

When it is necessary to spot grind the face of a part with a saucer shaped wheel the finish well be absolutely squore only if the network of the minute lines is crisscrossed

Because of its delicate cutting edges a broach gets hurt just as much on the return stroke as it does un the cutting stroke For this reason the alignment can never be too perfect

# New Scroll Saw of *I,000 SPEEDS*



#### The Most Remarkable Scroll Saw Ever Made ting-universal tilt

Now, for the first time, you can have a Scroll Saw that at a turn of your finger, gives you the exact speed that best fits the material speed that best his the material you are sawing—high speed for fast, fine work—low speed for heavy work—and ANY speed in between! In addition the new Delta Multi Speed Scroll Saw gives 24" throat capacity—Tim ken Bearing crankshaft, sbaft driven blower pump which makes air available even for sabre cut

ing table for bevel cutting as well as for straight cuts -a completely universal blade guide-bigh speed blade support -adjustable blade tensionsplash lubricated drive-tiling spring hold down-and many other features that have caused ex perts to call it 'The Finest Scroll Saw Ever Made' Fot full description, specifications and low

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## Colonial-Kitchen Model Added to Our CONSTRUCTION KITS

UN for the whole family is contained in the construction kit pictured above With it can be built a miniature Colonial kitchen approximately 21" long, 7" high, and 5" deep (see p 206) Accurate in every detail. the model is an attractive example of truly American architectural design mother, son and daughter can share the pleasure of putting it together and furnish ing it, although the work can easily be done by one person if desired

The kit costs only \$2.00 and consists of all the following walls, floor, ceiling, and fireplace printed in four colors on heavy cardboard, which must be folded into shape, turned legs for table, chair, and candle rack, other wood parts stamped on thin plywood ready to be jig-sawed apart, dowels for chair rungs and stool legs die cast metal androns, tongs, cooking crane bot tie, mug candle bracket, two pans, shovel, and mirror light kettle, two windows; jar of wax, and packages of pins and glue

Construction kits for building a wide variety of ship models three whittling kits, and a marionette kit are also available. The complete list follows

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(Continued on page 226)





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(Continued from page 224)

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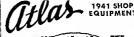
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HRISTMAS is lese than three months away so now is the time to start plan ning those gifts you intend to make for your family and friends To assist you POPULAR SCIENCE MONTHLY offers a wide variety of blueprints for constructing models furni ture boats toye radios and novelties A few of the projects are lieted below A complete list will be cent free upon receipt of a self addressed stamped envelope



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(Continued on page 230)

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## Tested Workshop Plans

(Cont nued from page 228)

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#### Mounting Prints to Enter in a Photo Exhibition

ANY print you expect to enter in a photographic axialities abuild be mounted to conform with certain well established requiraments. Even if you have no intention of sending prints to camera shows there are advantages in following axialities prefications in mounting your better enlarge ments to form a uniform collection.

The mount must be of light colored or white stock. The choice of mounting board which comes in several different surfaces and tints depends on the type of wall it is to be hung on

to be sung on Defaulte rules are followed in exhibiting prints this way. Although a few salons will apply the salon and the salon and the salon and the salon and the salons due no doubt to the available hing sig space and necessity for uniformity, require that all prints he mounted to permit mounts to be hung (Continued on page 253)



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vertically There are no borders on the en largement which is fastened to the board with rubber cement or dry mounting tissue

Good proportions can be obtained by mounting the photograph 23½ from the top of the mounting beard if the picture is 11 by 14" and 33½, '15 by 10. The top border is the same whether the picture is mounted vertically or horizontally Some photographers add title and a granture in penci making the letters about 3/16 high.

No hand colored prints will be hung by any of the larger photographic exhibitions. The entry fee which should be mailed under separate cover is required to pay for han ding and returning prints.

For home display the mounting board may be hung on a small picture hook with the ad of a loop of string glued to the back Neither string nor hook should show



## Water Colors Tint Photos

AMATUR photographers who wish to experiment with inting some of their pictures can do so at triding expense by using or durary water colors. Disable a little of the dearred color in a tray with chough water to cover the print. Leave the print in the solution a few moutes until the required shade is obtained then wish them with water. The color will remain

Although this is an unorthodox way to that photos it gives interesting results with certain types of bruts. For sumy seenes try yellow. For pictures taken in the late afternoon orange is appropriate. Snow scenes look realistic with a tinge of bine Light green is fine for country scenes. A light shade of red is good for pictures taken at sundown.

Ordinary clothing dies obtainable at all drug and dime stores may be used in the same way Simply add the die to cold wa ter until the desired shade is obtained.



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shots like that above with the second lamp on an extension And con venicut? It's a wow! You can put up to 30 in one coat pocket so there's on need to be out of bulbs when that prize shot comes along Try Midget GENO 5 and get snaps



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## His Vision Made Television

(Continued from page 76)

1924 at the age of eighteen he had fully worked nut the concepts of electronic tele vision essentially as it works today

His father died and Farnsworth had to put aside his dreams for a while and go to work He started a small radio shop-and ironically it falled. He got a joh in the rall road yards

At this point his luck changed however He met George Everson and Leslie Gorrell twn California husiness men They listened to him for a while and agreed to put up \$8,000 and see what he could do Farns worth was sure his star was set now he married a childhood sweetheart Elma Gard ner and the couple moved to Hollywood

Farnsworth turned the living room of his home into a laboratory At one time the neighbors got suspicious of the strange young man and the packages be was carry ing into his home and the sound of motors operating inside This was during prohibi tion and they were sure he was operating a still They notified the police and the place was raided. The inventor eyes blinking finally convinced the police no liquor was being manufactured on the premises Money frequently ran low and between

problems Farnsworth bad to beg his back ers for more In 1927 he had something to show for his work-his first patent the one on the whole system of electronic television At one of the early demonstrations Farns worth was asked by a banker whether he

saw any dollars in that pickup tube yet Farnsworth enswered by televising a dollar sign painted on a sheet of glass. The bank er laughed and coughed up more money

In 1928 Farnsworth gave a demonstration for the press in San Francisco and drew in ternational attention to himself years later he entered into an agreement with a large radio set manufacturer under which his research staff and much of his equipment were moved to Philadelphia

At the end of that period he established his own laboratory there and carried on re search until 1939 Then the plants were moved to Fort Wayne Ind

Farnsworth is the father of two boys Philo Jr ten and Russell Seymour four They live near Fort Wayne Music is the chief interest in their home and Farnsworth has started to study counterpoint and theory

He is a heavy cigarette smoker and a big time eater He is a good shot and a fanatic at auto driving He races his car up and down the countryside when stumped at the plant O New York World Telegram

extra)

## The Facts About FM

(Continued from page 72)

il at annoyance? Yes As long as the station you want to hear comes in twice as trong as any other station on the only the station of your choice the others will be blocked out completely. With AM one station must be from twenty to fifty times stronger than another before it gains the upper hand

- · But suppose an FM recener tons located hallway between two FM transmitters broadcasting on exactly the same fre a tencu? Which would you hear? other General Electric test will answer this query FM signals were broadcast on exact ly the same frequency by two transmitters one in Albany NY and the other in Sche nectady NY about fifteen miles away An FM radio was installed in an automobile and the car driven between the two cities In Albany and for about half the distance to Schenectady only the Albany transmitter could be heard Halfway between the two cities first one and then the other station would come in depending on the contour of the ground over which the automobile was passing But either station could be heard in this halfway zone when a directional an tenna was employed. As the car proceeded toward Schenectady, only the transmitter there could be heard. At no time during the entire run did the transmitters interfere
- Without getting technical just what is the difference between FM and AM\* To answer that without wallowing hip deep in technicalities is practically impossible even if you are one of the few radio owners who understand exactly how their sets function But with amplitude modulation the signal is broadcast on a constant invarying wave length with the sound modulations being accomplished by varying the power or am plitude With FM the reverse is true The power is constant, and the modulation is accomplished by varying the wave length or frequency within a barrow limit.
- Witt FM be used only for regular broad coating? No it has revolutionary possibilities in the fields of poince avantion and military radio as well. The Chreago Police Department after a series of tests with two patrol cars cruising side by side one equipped with at AM set and the other with an FM plans to install FM equipment in 200 police cars. The U.S. Army and Navy also bave been experimenting with FM



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# ROGERS

#### Rombers Reward

(Continued from many 63)

fighting forces. We still are short on quantity, but our gunners, guns, fire-control inatruments, and searchlights are as good as the best any ration can offer.

For defense aguint high-allitude majorbombardient aviation the 105 millimeter bombardient aviation the 105 millimeter initiatevist; gun is our most effective weapon It can deliver rapid and accurate fire to an allitude of over five nilles at a horizontal range of four miles But the "105" is a fixed gun so its use is restricted to certain strategically immortant hocation.

At pureon: the three non antistrent gun, which is effective against planes flygue, which is effective against planes flylig well over three miles up, is the most powerful mobile sky weapon we have in anything like quantity. A new unicety-milbracker gun now is considered standard unument, atthough its issue is just beguning. It is effectly at higher altitudes than the three luch gun, and the burst of its beavier shell creates a larger dancer conce

The snappy little thirty seven-millimeter antiaircraft guns, which fire 120 1½-pound explosive shells a minute, have proved their worth for use against planes flying helow 0000 feet, and the 50 caliber machine gun remains a decidedly effective weapon against daring hedge-hoopers

We now have seven antiaircraft artillery regiments in the Regular Army, and sleven in the National Guard At least twenty more regiments will be organized as soon

as equipment for them becomes available Balloon barrages have become familiar ornaments of European wartims land-scapes Officers of the Air Defense Comianad are convinced that, coordinated with pursuit aviation and antiatreast artillery, they would be a valuable addition to our air-

defense system No matter how efficient air defense methods may be, some planes are sure to break or sneak through, and the bombs they drop are certain to do damage. To keep that damage to the minimum, to care for the injured, and to prevent unavoidable confusion from deepening into panic police and civilian volunteers must be trained to perform special air-raid duties. This highly important part of air defense has not been Detailed instructions for airneglected raid workers have been worked out, and soon will be printed and sent to municipal governments for issue if the need arises

Everyone hopes that we'll never see or hear enemy planes over America—but the Air Defense Command is determined that if they ever come over we'll be ready for them!

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#### Speed Is His Business

(Continued from page 152)

ments of drams, have been provided by Wilbus Shaw There was the time when his can hit an oil slick and shot sidewise all cost the full length of the straightaway white he wrestled with the wheel to prevent a spin. There was the heartbreaking climax of another speed battle when he was streak ing along well in the lead and a throttle connection snapped Then there was the freworks of 1951 Out of control at his preed Shaw's car buried itself over the concrete wall landed upright and sithered to a stop. Unscratched he climbed out and finance the race in a tearmate's machine

Each year people from all over the United States send Shaw good luck charms to carry during the race This spring one woman forwarded a buckeye and reported she had won seven international contests since she had been carrying the luck bring ing nut From Long Island a druggist sent a tiny wooden man labeled Ptomaine He wrote that the figure was so lucky it was good for anything but money at the bank Just before he went to the starting line last Memorial Day Shaw looked under the seat cushion of his 350 horsepower \$20 000 Maserats and found what looked like the nest of a pack rat There were lucky pennies miniature horse shoes rabbits feet old washers and buck eyes A superstitious mechanic in the pit was taking no chances. He had collected all the lucky charms he could get and had hidden them in the car!

Most drivers are as superstitious as crap shooters. Shaw is pretty much of an exception. He is the only driver for instance who will let a woman have her picture taken sitting at the wheel of his machine—a thing that sends chills down the back of the average driver. The lucky charm Shaw re lies on most is careful preparation. Within driving is a business and a specialized science. He practices every track maneu ver until it becomes instituctive. He helps tune up his car to as near mechanical perfection as possible. He was the first driver in America to wear the common sense crash helmet which has since become conventional

In racing he explained you don't have to have good luck But you mustn't have bad luck'

His skill and preparations take care of his good luck and a pair of half heatted super stitions ward off the bad One of these is his lucky racing shoes a nondescript pair of leather sneakers he has worn in every (Continued on page 240)

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#### Speed Is His Business

(Continued from page 239)

race for fifteen years The other is his taboo against peanuts in the pit Years ago a Swedish mechanic named Olsen warned him that peanuts in the pit meant had luck on the track Shaw scoffed at the idea until at a race in California he saw a spectator munching peanuts lean over the edge of the pit to ask a question. Five minutes later he cracked up in the worst wreck of his career. There might he no connection between peanuts and crashes he decuded but the wouldet take chances Henceforth peanut munchers became taboo around the Shaw pit

After every victory Shaw receives a del upe of mail 'He sudden wealth is a magnet that draws letters from a thousand and one stock gelseme real estate operators charity leaders and impoversibled inventors People with dude ranches for saile people with mortgages that are going to be fore the people with mortgages that are going to be fore though delta and get rich quick schemes all at down with pen in hand to write to Wilhur Shaw

The queerest of all these communcations came in only a few weeks ago it was written by an elderly inventor. He desired back ing for a revolutionary idea that would simplify farming it was a machine so long that the front end would plant the crop the middle part would cultivate it and the rear end would harvest it?

Today Shaws private stable of highspeed whickes includes an anpiane he fines himself an imported motor cycle and three automobules—one of them a specially built roadster said to be the fastest private car in the World. At the end of his racing rain bow Shaw has found not only a pot of gold but all the speed machines he dreamed of having as a boy.

#### Novel Horizontal Billboard Read by Plane Passengers

GIANT lymg down billboards intended to be read by airplane paisengers may be an important new development in outdoor advertising What is said to be the first display of this kind has been erected near the Chicago III airport, on the roof of, plant manufacturing surgical dressings Built of neon tubing the horizontal bill board displays the firms trade mark in a figure twenty free tarcess The sign is seen by bundreds of arriving and departing plane passengers every day

#### Gus and Joe Go to the Show

(Continued from page 146)

have a blow-out, and they're said to make a flat tire ride as though it still had ten pounds of air." Gus declared

'Say' We can't afford to miss these Hudsons," he added "Look at the Six and the Six Traveler-116-inch wheelbases, engines which have been upped to ninety-two horsepower by increasing their compression, Symphonic Styling which assures the ladies a harmony of exterior and interior colors, and don't forget that goes for the lowprice group! Then there are the Super-Sixes and Commodores-larger and more expensive Lots of improvements on all of them-a cowl ventilator which you can leave open during the heaviest rain storm, larger brake drums, and a new clutch pedal mechanism which requires only three quarters as much effort to operate as the old one did "

Gus pulled out his watch "Holy Moses" he exclaimed 'Only a half hour to closing time, and you haven't even seen the new Buicks!"

Wide, low hodies, dashingly streamline, were the Buick features which first caught Henry s eye.

"Yes, they look good" Gus agreed with him 'But there are a lot of just as important improvements which don't show on the outside Increased power, for one One of the reasons for that increase is an amproved hearing-it took the Buick engineers five years to develop exactly what they wanted, but they've got it now. Then there's compound dual carburetion That's something hrand new It costs a little extra on the Series 40 engines, but is standard on the larger ones By using two dual-doubleharrel--carburetors instead of one, better mixture ratios of air to gasoline are fed to the engine, power is increased, acceleration and hill-climbing improved, and fuel consumption cut down Another new feature is the method of forcing fresh air to the carburetors with an air scoop set up in the radiator grille. The air is piped to the air cleaner above the carburetors and it's actually under pressure from the car's forward motion?

"There's another thing To squeeze the most power out of the gasoline, they've redesigned the piston heads so the mixture in each cylinder is compressed into a tiny hall right around the spark plug When the spark ignites it, they get the maximum pick-up and power from the explosion, with-(Continued on page 242)





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#### Gus and Joe Go to the Show (Continued from page 241)

out any ping or detonation-knock to you Say here's something Gus broke off

suddenly to the relief of Miller whose brain was beginning to knock a little itself under the high compression of Gus s explanations The Buick Bug Famous old racing car! Brother do I remember back in 1910 when

Long Chevrolet was busting speed records right and left with it Look at that radia tor-behind the motor Just a bunch of curved pipes with fins on them It didn't even have a fan then Notice that Buck had overhead valves then-and has stuck to them ever since Like Chevrolet interrupted Muller

They still have overhead type valves too bayent they?

answered Gus Right

Passing the Chevrolet display again Gus remarked They we redes gned the combus tion chamber this year so the new Chev rolets will turn up ninety horsepower in stead of eighty five And the wheelbase is increased to 116 inches to give you a stead ier amoother ride

Yoo hoo! Henry! Mr Wilson! Miller's voice was calling from across the aisle

They went over to her and Joe feeling properly ashamed of themselves for having played truant for so long But Mrs Miller didn't seem to care and Joe Clark was looking both self satisfied and family em barrassed.

I ve decided which car we want Henry Mrs Miller told her husband Mr Clark advised me about it so you needn't worry The Salesman is going to bring it out for you to see next Sunday morning And What do you think Mr Clark bas done?

Gus looked hard at his partner and Joe got red in the face

He s either robbed a bank and got away with it, or he s bought a new car Gus said. Well my old bus is worn out-you said so yourself Joe defended himself rather I'll bet you bought one your sheepishly self-it was you who wanted to come to the show

I didn't buy anything except my ticket to get in Gus said cheerfully I like all these new gas buggies too much to settle down to any one of them

Isn't that just like a man? Mrs Miller demanded Then she giggled. Mr Wilson I'll just bet that you felt the same way about girls and that's wby you never got matried

### Testing Your 1941 Car

(Continued from page 135)

out the assembled cars at the proving grounds How much water will spure up through cracks and slots in the floor? What will happen when the brake bands get wet? Can the aguiton system and the carburer's take a ducking without staling the car's A thirty mile an hour splash through the hathtub a street wide trough of water

settles these questions
Driving in circles of ever harrowing di
ameter provides a novel test for a car's situbility in turning corners. It also compares
the merits of various nonskut tires. At a
188 foot radius the motor strains and tires
acream as the test driver holds the acceler
ator down to the floorboard. A passenger
has to cling to the door had the specialistic
to cling to the door had been predometre
gradient only thirty two miles an hour
According to General Stotors men who de
vised the test that is about as fast as any
car will go in such a small circle because of
the power used up in forcing the car to turn

Another odd test shoots an artificial hur renne at the aid of the car so that the amount it swerves can be measured. At the Ford proving grounds the blast is provided by a four bladed fourteen foot propeller driven by a 750 horsepower engine admounted so that it can be aimed either hroadside or diagonally to create crosswinds.

How important car makers consider this intensive testing may be judged from the fact that in the up to-date Chrysler engineering laboratories as many as 2500 different research projects may be found under way at once Current experiments range from testing the life of seat cushions with a metal form meknamed the lead fanny to heat freating parts with radio wave.

For the latter purpose the engineers have designed an electrical device resembling the artificial fever or disthermy apparatus used in hospitals Placed in a high frequency coul without touching if a gear or other metal part is heated by induction from the inside out attaining a high temperature in a split second Valuable experimental data may thus be quickly obtained for nearly all of a car's mechanical parts owe their hardness or softness to heat treating

Perhaps in the future this land of electric beat freatment may actually become com mercial practice. It would not be the first time that car research men have pomeered an outstanding advance. Always they are working on two jobs at once—planning for the current year s models and for the car that may come some day.





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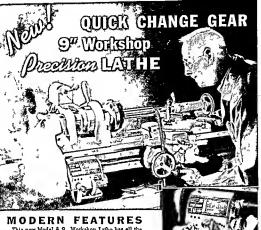
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1. ONE MIGHT I entered the compart ment just outside Gargantua's cage on a routine check up and forgot for a moment that Gargantua was always wating to kill me. Suddenly, with crushing force, he grabbed my left shoulder

2 "ALMOST PARA
LYZED with horror I
thought the end had
come Then I remem
bered the flashlight in
my right hip pocket
I whipped it out and
turned the bright
beam full into Gar
gantus a cruel glitter
ing eyes

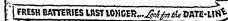




3. FOR AN INSTANT he glared into the hated light then relaxed his grip and tumbered to the other side of the case. Your dependable Eveready fred DATED batterjes saved me from a hornble death that night I will never be without them

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IN THIS FLYING TEST TUBE above Tommy Toml ason p oneered the newest wonder of a r travel-the Stratoliner He likes flying tikes Camel curarettes There a never a time-no matter

how much I smoke-that I don't set a fresh thrill out of a slow hurn ng Camel That extra flavor ts siways welcome

#### He turned to Camels for Extra Mildness

of flying - more hours above 30 000 feet than any other fiver 19 national secords for speed and endurance That's the fly ug log of Tommy' Toml ason above His smoking log would read 1 wanted more mildness in my cir. arette I changed to Camels and got what I wanted-extra mild ness with a grand flavor Slower burn ng Camels give

you she nasural mildness and coolness of costler tobaccos blus the freedom from excess hear and BEIGHING QUALITIES OF too fast busning Try Camels Get she extras-sociod az extra smoking per pack (see right)

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Inst before the ma den fl this of America a first Stratol ners -trrutosphere ace Toml mon (center) takes time

to enjoy a slow born ng Camel w th p lots Ot s F Bryan (left) and John E. Harl n (right)

In recent laboratory tests CAMELS burned 25% slower than the average of the 35 o her of the largest selling brands tested-slower than any of them That means on the average a smok na plan equal to

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quickly This indicates that the plug in use cools too slowly, or is of the wrong type

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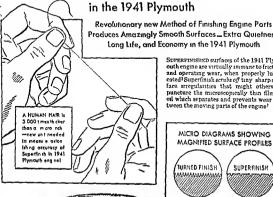
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Founded Monthly 1872

Mechanics & Handicraft

GEORGE H WALTZ Jr., Managing Editor ARTHUR WARELING, Beme Westabes Editor ALDEN P ARMAGNAC, Associate Editor SYDNEY OXBERRY, An Editor

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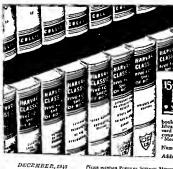
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#### "If I Could Only Recover Those Ten Lost Years The True Experience of a Man Who Almost Tennoled for IASalle Home-Stady Training if

In December, 1921, an American employed with a mining firm in Mexico, clipped and signed a LaSalle advertisement coupon. But he did not enrol?

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Ten years of alence followed ... ten years of hap-fazed jobs, found, weretak job at ht. Them, in January, sunders hirry law that hence was aboven by a dramatic fever, high-sported by the manual fever, high-sported by the state of the stat

he had moved from one position to another, only to training

No need here to recite those hardships-though in merice to him it is only fair to say that on four senarate justice to him it is only fair to say that on twir separate occasions he had almar enrolled... and that on each occasion he had postponed action because of some unspected reverse scenningly beyond his power to avoid "for five months now," so he wrote, "I have been for vacation". Not a change to take a course now—ac

cording to the carefully laid out and conscientionals

time in the last to years' supposing I has enroised, in the face of seeming disaster, even though I had had to borrow the money to do it' Supposing even that I had enrolled only five months ago, at the beginning of in enforced vacation! In all likelihood I could have martered the training by now Or I might in the meanwhile have found a congenial and profitable position, thanks

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to my successed knowledge. As it is, for all I know, there may be another five months without any position with all sorts of dim prospects. and meanwhile I am getting older . . "That settler it To blazes with further prograssination!

To thunderation with my sinancial program! The borround the money, and Pil borrow some more but Pil demonstrates as yellow the money and Pil borrow some more but Pil demonstrate with my time! This year us going to see a by change in my affair—and right here is where we start!"

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training that he needs. . and thus commands the un-folding opportunities of our new-day business world If you need to be convened of those opportunities, forget that you ever read this message. For those popor-

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many thousands of dollars! Men of action—hundreds of them—will use this coupon for their personal advancement Be one of those men who will steadily win



DECEMBER, 1940

Name .

# Our Readers Now He Has a Shop of His Own,

### He's Going To Catch Up

Belle e it or not I have been a reader of POPLLAR SCIENCE MONTHLY for about thirty years-not every issue of course but steady when I was located where I could get it I have nearly every issue for the last eight or ten years and now at long last I have a Ittle shop and am going to make many of the things described in those old numbers Many times I've wanted to write and say

COSH WHERE LL I BEGIN?

what a swell magazine I thought it was es pecially when I read some of the letters in Our Readers Say from fellows who wanted you to change the entire magazine to suit their one tiny whim Often I won dered why they didn't huy a book devoted to their partleular likes

COULD BY SPOOKS

You ve made a success of the magazine as it is and has been yet there is always some one trying to tell you how to run it chances are they couldn't run a peanut stand and make a go of it So I says says I keep her the way she is and more power to you -J P T

#### Leavenworth Wash Before Long, We'll Be Afroid To Go into the Kitchen

IN A recent issue one of your readers told of an experience with an exploding pepper \*haker Here is another mystery that almost parallels his case. We were preparing to go

on an outing and had packed several things to take along including a glass jar of ground coffee It rain ed as it usually does so we were spending our time at home when we heard a no se like glass breaking in the kltchen Investigation showed that the top of the coffee par had



about fifty five degrees and the temperature of the ground coffee was normal The hid was not too tight and the jar was not in a draft I wonder whether any of your readers can offer an explanation for this mysterious ex plosion -L. P Huntington Ind

#### He Knows What Makes the Wheels

Go 'Round-Bockword' ALTHOLOW I am only fifteen years old I happen to know the answer to the question asked by G B of Riffle W Va about wheels that seem to turn backward in the movies It hothered me at one time The reason the wheels appear to go backward is that the movie camera takes one picture when the spokes are in a certain position and when it takes the next p cture another spoke is in a position at ghtly back of where the first spoke was before When this is repeated many times the spokes appear to move backward As the wagon slows down the camera catches the spokes in their proper positions and the wheel appears to move in the right direction -G M Columbus Ohio

Many readers sent in letters answering GB s question We publish GM s because it is so clear and simple and so good an example of straight thinking in a fifteen-year old -Ed

#### Physician Misses Monthly Mental Going Over

WHAT happened to the Question Bae? Now I have no way of knowing how dumb I really am Better set busy and check up on me next month -(Dr) DWK Seattle Wash

For a real mental test we suggest that the Doc try thinking up some questions these birds cant anstoer -Ed



#### That Sigmese Twin Bike Is Still Going Strong

M L of Winnipeg Canada says that be and his cousin reached speeds approaching fifty miles an hour on a pair of bicycles hooked together I recently made a twenty seven mile trip on my own bleycle alone in ninety-one minutes. A few days later I made the same trip with a friend using our bikes in Siamese twin style and this time it took much longer I was not loafing on the rear seat either One disadvantage of the two-(Continued on page 12)

10









Trained Radio nado Trained Radio Technicians make good money and you don't have to give up your present job or leave home to levin Radio I train you at home to levin Radio I train you at

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WALL ALE PURIC VICING INSTRIBUTE RANGE HOLES RAINE ROY FOR FOR FOR FOR LARGE FOR EASTER THE PURICE PARTIES OF THE PURICE J. E. SMITH, President Dept. ONP3 National Radio Institute Weshington, D. C.

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> City..... State.

# Our Readers Say (CONTINUED)

b cycle plan is that the rear man must use bis brake first and he cannot see ahead very well—DD Toledo Ohio

#### Introducing Si, the Big Guy Who Draws the Little Guys"

Wirk the changes you have made in the size and make up of FSM I think it beats any other eventific magazine on the market regardless of price I am offering no sig gestions for improve



gestions for improve ment but there is one thing I would like to mention I get a high kick out of the little guys that decorate the pages of Our Readers Say and I think the art stwho draws them should come out of hiding and take a bow —AC Jr La Monte

When he is not showing yot the insides of some completed gadget like the Palomar telescope [gage 107] B G Seielstad gets a lick out of aroung the little guys Such is his modesty that the accompanying self-portrait doesn't do him just or Ed.

#### That Gun Cabinet Hit the Mark with This Michigan Trapper

That Gun Cabinet of Knotty Pine de scribad in your September issue works fine in my trapping cabin Put more of that kind of stuff in PSM—LWF Gaines Mich

#### A Question of Grovity Has Him All Bolled Up

Suppose you had two metal bails and the larger one was hollow so that the smaller one would go inside it Suppose the smaller bail could be placed in such a position that the smaller bail could be placed in the smaller bail could be placed in the smaller bail could be placed in the smaller bails of the smaller bails and the smaller bails and the smaller bails and the smaller bails and the larger one was the smaller bails and the larger one was bailed by the smaller bails and the larger one was boiled by the smaller bails and the larger one was hollow so that the smaller one was bailed by the smaller bails and the larger one was hollow so that the smaller one was hollow

one would go inside it Suppose the smaller bail could be placed in such a position that their centers of grav ity on ended Since the force of gravitational attraction between them varies inversely as the square of the dealer of the dealer of the dealer of the dealer of the force of attraction would be practically infinite and the smaller of the smal

would be practically infinite and the smaller ball would be supported in mid-sir This does not seem reasonable to me so could one of your readers point out my mistake in rea soning?—RTS Kirkland Lake Ont Canada

Ship Model Builder Wonts More Old Time Vessels

IN THE past I have greatly enjoyed building your ship models such as the Malek Adhel and many others I know that Captain McCann has passed on hut don't you think that these models of old time ships should be continued—ME Boston Mass

#### What We Need, He Believes, Is Ta Leorn How To Live

How many of your readers would be interested in a series of articles to comprise a course in inorganic chemistry and qualitative analysis? Also a similar series on microscopy and elementary hacteriology? I certainly think these would be better than all

IT TAKES CHEM STS AND SUCH TO MAKE EXPLOS VES AND OTHER WAR MACH HES



the articles and pletures on war and its adjuncts which appear so promiseuous ly in all magazines and newspapers now Such a ser es of articles might start some yet unknown person on the road to the companies of the person of the road to the companies of the new drug to combat tubarculosis new methods of fightling

industrial diseases. Wouldn't that be better than all the art cles on new hombs dive bomhers death rays (\*) and so on? What this world needs a more and better schools and teachers hospitals and dectors labora tor es and scientists to help us to learn and live not to die—HWF Bridgewater Mass

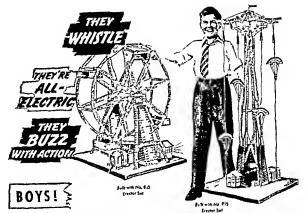
#### A Plea for a Department on Doing Nothing Efficiently

You a new subject matter grouping of pages with the convenient in dex is another step toward perfection It is observed also that HAVE CCC BOYS THAT WE CCC BOYS THAT WE COKE TO DO!

toward perfection It is observed also that this month brings you (us) a new greatly enlarged Automobile Department Let er come I suggest another improvement by supplementing Our Readers Say with a department of Occu

department of Occu pation for Nothing To-Do People How To Do Nothing Efficiently B where that during the

and one of a one of Nothing Efficiently By the way I read sometim rea where that during the last six years CCC Canada boys have built 44 000 bridges 110 000 miles (Continued on page 14)



Look at that towering Erector parachute jump with electrically illuminated top. You build it your self Piece by piece you fit the long gleaming girders together—attach the parachute rigging—and in stall the powerful Erector revering electric engine.

And now for thrilling action! Blow your whistle throw your engine into gear and your parachutes are hosted up and up until they strike the release mechanism. Then like a flash they plummet down ward—unfold—and larly float to the ground.

Now get a load of that m ghy? Ferrs wheel It white—two mikes with j ght—noperates me there are treation at slow or high speed. You can bu lid hand deeds of spectoular real situ mechanical many with one Exector set. And how the Exector electric ring ne makes them burz with one the new Exector set your rearest toy store. Take Dad along Exectors at your rearest toy store. Take Dad along

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# Our Readers Say CONT NUED

of roads and 5 200 000 dams Aren't there sny CCC girls? If so what have they been doing all this time?—HE Mexico City Mexico

#### Another Solution Would Be To Motorize on Ash Troy

As a solution of the problem of smoking in a car what would you think of a built in ash tray in which i he bottom swings out on spring



h nges when you press a buiton atlow ng the ashes to go down a pipe and fall on the road? It seems so me that it is would be bet ter ihan ficking the ashes out the window and gett ng ihem back in your great and the seems so me that it is would be bet as the seems and the seems when can ample out though the seems which can badly be emptied without dismantling the whole

automobile —DJB Chicego III
Since PSM Soys So,

We Must Be Wrong

You state that Sikorsky's new helsopter was the first to make a successful vertical fight Maybe so in North America But look back through your files to June 1928 and back through your files to June 1928 and beleopter being flown by a girl in a German beer garden. As you correctly stated this eraft was the first to siay in the aft for any length of sime which an Italian one failed to do It is much more compact than its BO Hallars, VB Canada.

E G is right Some day we'll get around to reading this nagazine of ours -Ed

#### This Problem in Circles Should Be Easy os Pi

Hear's a math problem to help you along. All the arcs in the figure are semicircles

The in CD is stretch of the large means of the shaded portion of the figure? Use piequal to 22/7 CD equals fourteen inches —RSK, Chicago III.



OF THE SHADED FORTIONS

#### Gus Wilson Helps Stort a Puerto Rico Workshop

WHEN I sent Martin Bunn a little informa tion to use in his Gus and Joe stories I was not expecting to earn any money by it How ever I am very grateful for the five-dollar check for it started my home workshop I used it for the down payment on a bench saw and moior My regular job is as a power plant operator and on the side I act as auto me chanic for neighbors and friends Once in a while I get a queer problem The other day I got one that had me stumped Perhaps you will let me ieii you about it some iime but I am not expecting to get paid for it Maybe it would show somebody somewhere how is cure this same trouble Wishing Gus Wilson carloads of good luck and many years of fruitful life P S Is Gus married or a hachelor?-RF Isabela Puerto Rico

Aus is a confirmed backelor As he once remarked Cara are cranky enough but after about suenty years of study a fellow can sori of figure what one of them is going to do next As for women —Ed

#### Here's One Trick the Enemy Would See Through at Once

Would's the a help to the United States If we got into a war of the make planes out of transparent plastic? Then when you went to bomb the enemy they could bear the motors going but they would see right through the planes and bombs would be hard to see up in the sky—WH Mimmi Fia.

THAT WAS EITHER TR ED OR AT LEAST SUCCESSFED DUE NG WORLD WAR 1

#### We Got Off on the Wrong Foot With That Corn Rozor

For the last five or any years I have noticed a queer unsignment in my father possession. When I liquired about it I learned that it was a corn range my surprise when I saw it described as a new device in your Sepjembre issue I don't mean to knock the Sepjembre issue I don't mean to knock the Sepjembre issue I don't mean to knock the What puzzles me is how it happens to appear as somelhing new The one you illustrate is the identical twin of the one my father uses faithfully—3 M White Piains NY

Apparently the razor described in our September issue was not a brand-new invention but an improved product—Ed



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# Helps for the Home Owner



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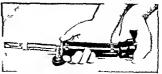
#### Wall Covering of Linoleum Now Available

LINGLEUM long used for floor coverings is now be ng employed for covering the walls of bathrooms k tchens and playrooms with a wide selection of patterns and colors available The covering s except onally easy to apply A strong adhes ve base is first brushed onto the wall to be surfaced and the II noleum then rolled into place over t as shown in the photograph at the left Open ngs for 1 gbt switches and other wall project ons are cut out with a sharp heavy knife Being completely waterproof linoleum walls can be thoroughly scrubbed and washed when they become soiled without any possiblty of damage to the surface Furthermore since they are fadeproof they are not affected by exposure to strong sunlight. The material makes decora t ve effects possible in rooms where wall paper

would not be practical

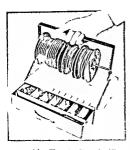
#### Single Unit Combines Blowtorch and Soldering Iron

Bio roscit and soldering iron are combined in one unit now available to home repairmen. Sther gasoline benefits or denatured alcohol blowtorch whose or the rated films heats up the units soldering point within three mutters. The torch regulating valve at the end of the units soldering from the soldering from when it is not in use.



Concent ated flame from the blowto chin the handle heats the sol deceg on point. The flame egulating valve serves as the rest





#### Portable Electric Repair Kit Holds Tools, Wires, Parts

ELECTRICAL work around the home should be made easier by the portable wring kit pictured above Spools for wire are mousted on top of the metal kit box, which contains a drawer of compartments for screwa in cultumg materials and other small wiring parte A twelve inch rule is marked along the edge of the case just above the drawer



#### Circular-Spray Shower Head Takes Less Water Pressure

BECALSE if requires less water pressure to provide an adequate soft spray a new shower head effects a saving in the amount of water used No small holes are used water squirting out around the sades of the shower head face in a controlled circular stream. A ball joint allows the head to be adjusted to various angles.

#### Rubber Molding Seals Edges of Built-In Bathtubs

DERMANENT water tight and decorative rubber molding in strip form is now marketed for scaling the joint between a built in baltitub and the adjacent wall. The molding which is flexible to follow the contour of the tub is made of sponge rubber faced with solid rubber that is not affected by soap or bot water



go ats laset shows how the materal is applied

#### Midget Fire Extinguisher Is Handy for Home or Car

A FLASH LIGHT SIZE fire extinguisher only six inches long is now offered to home owners. Sold complete with a tubular case and wall bracket the unit has put out small oil kerosene and gasoline fires within fifteen accords in tests. Breaking a metal tp puts the extinguisher in operation.



# INVENTORS

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#### With the Inventors

(Continued from page 20)

conventional hearing aids Tiny batteries that operate the device are installed within the bows of the glasses TO PROVIDE SKIERS with a way to obtain better control on downhill runs Hans Thuring, an Austrian inventor, has patented the odd ski sails shown in the illustration Made of balloon silk, sail-



cloth, or a similar meterial the salls are cut

so that the lower ends can be fastened to the ankles of the skier by means of loops and elastic straps At the upper edge the sail is turned back to form sleeves, into which the skler places his arme When running down an exceptionally steep clope, the skier can apread out his arms and let the wind enter the bellied sail which then will act as a wind brake to slow him down to a safe speed The sail may also be used as an aid in turning to one side or the other ONLY TWO WHEELS are used on a roller skate petented by William H Decker, of

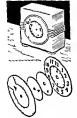


Shawnee, Okla Each skate has one rubber-tired wheel placed at the front and on the outside of the foot, and a second wheel placed at the rear and on the inside of the foot According to the inventor, this arrangement makes it easy for the skater to change the direction of his travel. and since the wheels are rubber tired and con-

siderably larger than conventional wheels. skating over rough surfaces is possible without greatly affecting the skater s balance or causing him to fall The skates are steaded by a vertical steel brace which is strapped (Continued on page 23)

(Continued from page 22)

to the outside of the skater a leg NATHAN HAWNER of New York City is responsible for a novel clock which has no hands The timeplace utilizes four dais placed one over the other, and all moved by the same clockwork mechanism The outside dail transparent except for an opaque ring around the



outside that has one transparent open ing is used to ind! cate the hour The second dial contains an opaque arrow which indicates the minute and the third dial has an opaque arrow that indicates the secand The fourth dial is marked with bour numerals around its outside rim and minute and second markings nearer

the center Quoting from the official rules of

practice of the U S Patent Office When ever, during a time when the United States is at war publication of an invention by the granting of a patent might in the opinion of the Commissioner be detrimental to the public safety or defense or might assist the enemy or endanger the successful prosecu tion of the war he may suspend action on the application therefor NO MOTOR is required to operate an automobile turntable invented by Fred W Jacobs of Louisville Ky As the car is backed up onto the raised circular platform its rear bumper engages a standard which is connected by means of



a cable to tension springs installed in the garage By the time the car is in position on the turntable, enough energy has been stored in the springs to spin the platform around Before being used again it is returned to its original position by hand

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(Continued on page 26)



Scale model of an Early Colonial kitchen assembled with Kit 13 It is 21" long 7" high, and 5 deep

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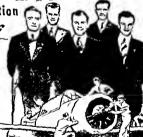
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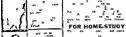
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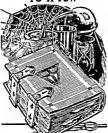
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I WAS PICKED UP and rushed to a hosp tal where prompt med cal attention saved my eyesight. That I enjoy the bless ng of normal vision today is due to Eveready fre b DATED batter es You can bet Im never go ng to be without them!

(5 guet John C Emmons) The word Evercady" is a reg stored trade-mark of Natural Curbon Co. In

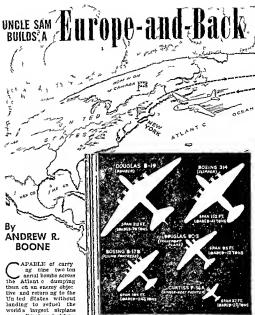
FRESH BATTERIES LAST LONGER.. Look for the DATE-LINE

NATIONAL CARRON COMPANY INC. 30 EAST 4244 STREET NEW YORK N Y La f of Laner Cerbed Tild and Gerben Curbers on



lealth and a famous father are two stum biling blocks in the way of success. At least that was the short pains not on of Edward R Steinmus Jr For Little Stef as University of Virginia classimates tagged him swapped his college blazer for the grimy overalls of a forty cent an hour General Mortos laborer And his not on must have been right for just seven years falter the motor moulis lettered "Vico-Piesadent on his office

door And seven years after that the whitehaired black browed stripling of thirty seven stattled the industrial world by becoming head of one of the largest corporations on earth U S Steel Now at forty he has tossed aside that \$100 000 job and is collecting his dollar a year providing the mountains of raw ma terials necessary to satisfy the monstrous appetites of the thousands of factones that are granding out guns tanks and planes for na tional defense Whether slashing red tape in Washington or calmly discussing the health of Hereford cattle or Belgian draft horses on his Virginia farm Little Stet constantly exlibits his amazing genius for getting all types of men to oul tooether in a common cause



soon will be launched from a fiving field a southern Cal fornia Known as the U S Army Douglas B 19

the long range bomber can cl mh with its eighteen ton lethal load to an alt tude of 22 000 feet and speed through the sky at 210 m les an hour Its wing spreads 212 feet from tip to tip and four 2 000 horse power rad al eng nes turning sixteen foot three blade propellers will give it more power than ever before has been supplied to an atrolane e ther miltary or transport. For four years 500 engineers and me chanics have worked secretly at des gning the bg ship and construct ng its parts Recently working with clocklike precision from a carefully checked script, they guided the gigantic structure from the maze of steel girders in which it was fabricated

## Warplane

and gently turned the fuselage and wing from a vertical to a horizontal position. When the engines are installed and gasoline poured into the wings a crew of ten will test fly the new leviation. It will have a total weight fully loaded of 140 000 pounds to building the new weapon of the sky

In building the new weapon of the sky engineers concentrated on range and striking power rather than on speed Including a tricycle landing gear and a retractable asse wheel the ship is constructed entirely of metal. Its wheels eight feet in diameter



will disappear during flight in huge wells under the wing. The ship measures 135 feet from nose to tail and the tail assembly stands as tall as a three story building. Towering forty two feet above the earth the fin alone has an area larger than the

The U.S. Army & B. 19 world & b ggest a rplane takes shape in the huge Douglas factory in Californ a







Fuseloge and wings we elfab a coted in a velocal position and a mose of gides. Selow mechanics at work in the comy cocipit connecting the many control cobles.

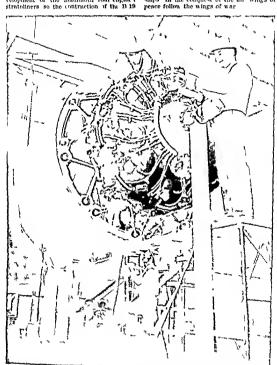
wings of the large twin engine transports operating on the nations air lines All the huge load of fuel required to drive the mam moth bomber on its long range flights will be carried in the wings in self scaling cells that will prevent ex cess ve loss of gasoline if the wing is punctured by bullets or shells Baffles in s de the fuel tanks keep the liqued from splashing about. Under certain cond tlons

of weather and load the plane will have a range of 750 miles Bristing with cannons and mach ne guns the will be the most formida it will be the most formida it will be the most formida ble fortress of the air ever designed. When I shall be 19 will be used as a laboratory for be used as a laboratory for

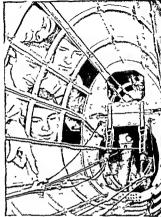
assembling an i checking tactical an i structural information from which may be developed large cargo an i troop transports for the future

Just as the Army's pioneering with the Flying Portress paved the way fer the development of the mamment four engine in the contraction of the B 19

may blaze the trail for larger connected asy liners It may not be long before a plane like it e B 39 will be carrying passen grea scross the Atlantic Airendy Pan American Airways is planning an ocean sorter with security on 150 passenger white in the congruent of the fair wings of



One of the plane a four 2 000 horsepower ang neabeing mounted in a dummy wing section for cooling tests



Randolph Field flying cadets studying their subject at first hand

### **Army Flying Cadets** See Plane Structure Through Open Panel

Cur away to reveal its interior mechanism, a fuselage of a hig twin-motored plane helps train future Army flyers at Randolph Field Texas Through windows made hy removing sections of the metal covering from the ribs, a clear view may he had of all the intricate control cables and wiring that go into a modern fighting craft By firsthand study, under the direction of an experienced instructor, the flying cadets nuckly familiarize themselves with the purpose, appeerance and mechanical design of each essential fitting which out of sight during flight, nevertheless performs vital functions in control, operation, and performence of the giant aircreft The illustration at left shows a group of them peering through the bared ribs to find out, with the aid of the Windowed section, what makes a plane work

### Mobile Air-Line Ticket Office Rides in Auto Trailer

SET up in an auto trailer and towed across country a mobile air line ticket office onerated by Eastern Air Lines cerved travelers during the presidential campaign Those who made special tripe to Elwood, Ind. to hear Wendell L. Willkie s speech accepting the Revisiblean homination, found the office parked at the scene as shown below Stepping unside the door of the trailer where a completely equipped information depart ment and ticket office were set up, they could obtain reservations for plane travel

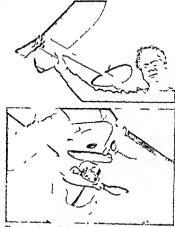


### Spare Motor for Model Plane Is Installed in a Jiffy

IF THE motor of his model plane balks during a competi tion Michael Reechman New lark for doesn't care simply detaches an under sec tion containing the tiny gas oline engine and substitutes SDATE Ingenious design makes the power plants so readily interchangeable that only a few seconds time is re quired According to the soung designer the innovation does not interfere with the flying qualities of the plane which lands upon a wheel at the bot tom of the remarable unit Re cause of its shape the builder calls it a hatchet plane

### Airplanes May Get Hydraulic Drive

Hibraulic drive recently introduced in automobiles is applied to atripianes in an invention by Charles Adier Jr of Battimore Md Pumps operated by the planes engines force a fluid such as glycerio r light oil through pipes to turn turbinelike motors connected to the propeller If one eagine fauls all propellers can still be kept spinning



Changing motors on Michael Beechman's gas powered model plane is as easy as this in the upper picture the builder is seen with the model ready for flight. Note the landing wheel at the bottom



### Air-Cooled Engine Hits New Mark of 2,000 Horsepower

CILLED the world s mightiest air cooled motor for planes the eighteen cylinder glant Вť marks a new advance in the quest for greater non er Four of 2000-horsepower Wright Cyclones will propel the enormous seventy ton Douglas bomber under construction (page 56) Meanwhile secret experi ments are reported under way with a liquid cooled 4 000 horsepower motor of forty two cylinders

# STREAMLINE MOTORS for Streamline Warplanes

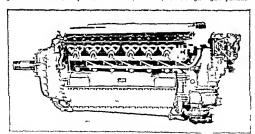
CONDENSED FROM

FORTUNE JULY 19

EER and there in the United States
like gangla in a vart nervous says
tem factories are working at for
speed in the production of power
plants. The world is fighting a war of mo
tors. The explosion an in eighne cylinders
have become as important as the explosions
in cannons and machine guan. The queck
production of bigger and better engineer for
of the day. That is a front page problem

The more exguiscant of these two engines of war is the motor used to power pursuit planes and bombers the combatant and striking arms of the sur force. Because of the great speed required in aerual tactics motors for warplanes are now generally of 1000 horsepower or more. In this country there are three manufacturers of such en gree that are row on a production beass.

Two-Pratt and Whitney and Wright-are established manufacturers of high power radial motors By December each will be turning out 900 of these air cooled power plants a month The third is the Allison Di vis on of General Motors at Indianapolis' which makes the Allison liquid cooled mo tor ranging from a twelve cylinder job rated at 1090 take off horsepower to a twenty four cylinder job now in the ex perimental stage tentatively rated at 2 300 The company sometimes ships as many as four or five engines a day sometimes less This winter when its present production plant will have been doubled the manage ment expects it will be turning out 100 en gines a week or 5 200 a year. The engine has already been accepted as the power plant for the Curtiss P-40 and the Bell P 39 (Arracobra) both single engine pursuite



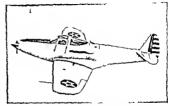
This is the Allison Equid cooled a plane engine accepted power plant for several leading types of Eghting craft. It enables designers to build more speed and moneuverability into warplanes

the Bell FM 1 (Airacuda) a twin engine multi place fighter the Bell XFL-1 (Airabonta) a Navy single engine fighter and the Lockheed P 38 a twin engine interceptor This acceptance was based on a model test applied by the Government to motors made in the experimental shop The Allison has yet to pass the production type test which is applied to the engine made in quantity in the factory

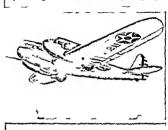
If the production of Allison engues meets the managers expectations the country a annual rate of production of high powered engines will be about 27 600 Th a will be enought to power 18 000 planes for one engine should be held in reserve for every two in service. However since many models will need either two or four engines the number of planes will be about 12 000 planes will be about 12 0

One of the reasons why the Government looks with hope at the Aluson engine is that high nowered motors up to not have been put out by companies spe cializing in their manufacture Alliann however is an engine controlled and sponsored by Gen eral Motors a fact that has caused the governmental and non ular bel ef that the industry is now going to achieve mass pro duction This supposition has been based partly on the further fact that Allison in a way is a descendant of the Liberty engine of World War I a mass produced motor of 400 horsepower

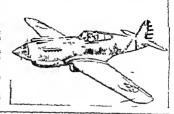
However there is a great difference between the effort of 1917 and the effort of 1940. The Liberty engine failed as a undrary weapon ahroad chefly for the reason that the design engueers had too short a time to do the job. That they had the right idea was proved by the performance of the Liherty after the War. The Alh son engine will also be mass produced but under more favorable conditions. There has been sufficient development time and or ders for the engue have made it



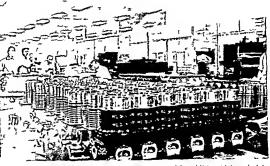
In the Au acabra the engine s behind the plots cock



The Arocuda carries its two All son moto's in the rear of the gunners compartments giving the guns full play



The pencil shape of the A mys Curt as P-40 pursuit ships made possible by the use of the liquid cooled engine



Assembling cylinder blocks in the plant of the Allison Division of Gene al Motors at Indianapolis Ind

possible for General Motors to tool up In deed, the preparation has been so thorough that General Motors can actually build bet ter engines by mass production tools tech nique than can ever be built by hand. The finest handcraftsman cannot duplicate the accuracy of American machine tools The problem is not so much in the application of the methods of mass production as it is in the adjustment of tools to operations upon materials that hitherto have not been subject to such machining. This is a matter of observat on adjustment, and practice m op eration. Actually there are many tolerances in General Motors gasoline automotive en gines, and especially in its Desel engines, that are as fine as those in the Allison. There are however more parts of the Al have engage that require micrometric after tion to himits than there are in the other General Motors engines.

THE Liberty which was also a V type high-decode engine was rebuilt after the War in the very shops near the indian apolis Speedway where vorman Gilman, an ingenious 'hankee mechanic who had worked with Jim Allisson on the old Liberties planned the first Allison. Convinced that the engine of the future would be highly cooked, he discarded water as a cooling agent and designed an engine especially for the use of a chemical cooler. This was in 1931 two years after the Allison plant had been

bought by General Motors On April 23 1937 the first Allison motor passed the 150 bour test and the long struggle to get it into mass production began.

The engineers who are bringing it into product on give three major reasons for their belief that it may prove superior to the art-coled radial types to which most of our productine capacity has been devoted. Their reasons are first, the air resistance or drog is less than in the radial second the coled reasons are first, the producting the second producting are the second reasons are first, the product has the air-cooled motor of the second m

The claim of less drag is based chiefly on the difference in frontial areas the twelve cylinder Allison has a frontial area of six and a quarter guarae feet as against an area of over anxiens square feet in the radial engine of the same horsepower. The lower area is a result of the V shaped des gn in which the cylinders are in one arranged which the cylinders are in one arranged the sumburst arrangement of the sur-could radial. Drag increases as the square of the speed if the speed is doubled the air resistance becomes four times as great.

Distinctly more important is the fact that the Allison engine being cooled by the flow of figurd around its cylinders instead of by a flow of air need not be directly exposed to the air It can be completely hidden in the wings or go back toward the tail. This freedom of the engine position gives the designer a greater opportunity to design for maneuverability which modern war technology and tactics may prove to be more important in combat than a few more miles an hour The Airacobra is a case in point Here the weights of the engine the pilot and the fuel are clustered around the ships a center of gravity. Here again fast han ding of the ship is helped by the better combat and searching vis on afforded by the pilot's position over the leading edge of the wing Moreover this plane requires a fuse

lage only thirty four inches wide-less than six times the width of this page—to take

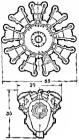
the compact Alitson The Allison engine can maintain top speed longer be cause it is easier to cool In stead of water which was used in the Liberty engine the cooler is ethylene gly col the same chemical used in nonevaporating automo bile antifreeze solutions Ethylene glycol is a by prod uct of the synthetic production of giveerin Its hoiling point is 387 degrees com pared with the 212 degrees of water The nump forces it through the engine so swift ly that the heat diss pation is uniform in all cylinders

That's the Allison side of it There are engineers es pecially among the makers of

air cooled engines who are not certain that Allison is all that its back ers claim. Most of them accent the stream lining advantages but they find them offset by the profilems of installation. But this is a technical debating ground where time and

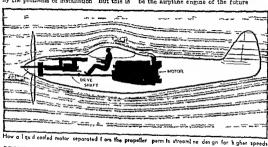
The name Allison is a renembrancer of Jim Allison who with Carl Fisher founded the Frest O. Lite Co and later established the Indianapolis Speedway so that they could play with racing cars Allison put up a machine shop to design and service the cars and gathered a staff of engineers and mechanics whose superintendent when the US entered the World War was Norman Gilman an old fashioned Yankee mechanic When the warended and surplus Liberty en

gines were heing overhattled Allison obtained a contract to do some of the work. It was then that Gilman invented the famous Allison hearingbronze integrated with steel -which solved the problem of getting more horsepower out of the Libertles When Allison died and General Mot ors hought the plant (1929) to secure for development the bearings and a Diesel engine then being designed Gilman Was made president and con eral manager of the new divi s on He huilt gears and propeller drives for the Navy dirigibles and many special engines and hegan his study of the liquid cooled type through work on the German engines on the Los Angeles our trophy of the World War The air cooled engine had at tained about 400 horsenower



COMPAR SON OF FRONTAL AREAS OF ITAD AL AND IN LINE MOTORS

but Gilman like one or two other engineers became firmly convinced that the liquid cooled type of power plant was destined to be the airplane engine of the future



DECEMBER 1940



# Sound Guides Rocket Bomb Against Enemy Aircraft

GUIDED entirely by sound a rocket bomb developed by J R Fish a West Springfield Mass inventor is designed to zoom straight for an enemy airplane at the almost incredible speed of 900 miles an hour According to the inventor the rocket incorporates mag netic controls actuated by acoustic appara tus steering itself directly toward the sound of an airplane motor to explode with ter rifie force when it reaches its objective Ord nance engineers of the U S Army are said to be interested in the rocket projectile and to have arranged a secret test of it on an un inhabited island off the New England coast



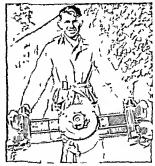
bolloon is used to equalize or pressure

### Balloon Ends Discomfort in High-Altitude Flying

To MAKE things more comfortable for pas sengers and pilots flying at high altitudes Dr Ralph Greene Miami Fla physician and medical consultant to Eastern Airlines developed the balloon device pictured at the left. Costing only a few cents the small bal loon has a nipple fitted to its neck When high aftitude pressure becomes annoying the passenger inserts the nipple in one nos tril closes the other with his finger and in flates the balloon He then squeezes the bal loon slightly and swallows. In this manner the pressure of the air within the inner ear is equalized with the outs de pressure

# Engine for Light Planes Weighs 130 Pounds

AN AIRPLANE motor that weighs considerably less than the two pas sengers who ride in the plane it pow ers-that is the accomplishment of Julius Dusevoir Inventor of San Leandro Calif Actually tipping the scales at only 130 pounds the light weight motor is rated at seventy five horsepower and will power a two place light plane with ease. The engine air cooled and of double opposed type util zes a built up roller bearing crank shaft a development perfected some time ago by the same inventor One other outstanding feature of the light weight motor is the fact that it can be dismounted and dismantled with noth ing more than two wrenches as tools The lightness of the motor gives the plane in which it is installed increased pay load or larger fuel capacity



man can easly ! fi this seventy five horsepower motor

### Signal Lamps Direct War Pilots in Patrol Formations

PICTURED in a recent action patrol along the Danish coast the British airman shown below in an American built Lockheed Hud son plane is making use of a special signal ing lamp to give instructions through the

plane windows to other craft in the patrol formation By this means the leader of a squadron or group can aignal units under his command without using his radio and thereby revealing his position





John C. Garand cleate of the U.S. Army's powerful new semicutamatic life ape at high at 1 pless

# the invented the world's Deadliest Rifle

By EDWIN TEALE

HE Un ted States Government is lay
ing a \$15 000 000 bet that the new Gar
and semantomathe rife is the deadliest
firearm ever intended. At the great
sprawking Sprangield, Mass., Armory orig
insily established by George Washingtone
Garand guns by the thousands are whizeing
off the production hines while out de
swarms of weighted the through the con
gruetion of a wast adultion to the plant.

Reams of puble t; have carried the news of this rifle to practically every wide awake U S e tizen. But what about the man behind this particular gun? Who is this Gar and, and what is he! ke? How d d he hap pen 'so ment' the weapon traft will make every American doughbo; is one man ma ethic gun uset?

Aleri, athletic square jawed—that was ny first impress on of John C. Garand when I walked into his Springfield Armory office a few weeks ago. As you talk to him, you not ce that he pronounces certain words of the control of the con

dren His mother died before he was eight years old and the family moved south to Jewett City Conn Here at twelve an age when most children are still in grade school young Garand started work as a floor sweeper and bobbu hoy in a New England textle mill textle mill.

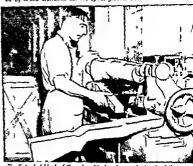
Machinery had always at tracted him Even today Garand s idea of an exciting night's reading is to settle down in an armchair with a pile of machine shop maga zines beside him During the short rest periods while the bobbins were filling up the hoy used to haunt the end of the plant where the textile mechanisms were repaired The foreman noticed him took a liking to him and let him pick up extra pennies scouring down rough places on spindles with a piece of hulding brick A year after he came to the mill Garand was a boy inventor with a patent of his own He had designed a new type of lack SCIEW

As soon as he began mak ing money Garand started saving toward a rifle With one of his brothers he used to spend evening after eve ning poring over the gun pages of a mail order cata logue debating the merits of the different firearms Final ly the boys pooled their re sources and sent off a money order for a Winchester 32 20 When it arrived with a blue shiny barrel and smelling of fine oil they discovered it had such a range that they couldn't shoot it without en dangering cattle and farmers for miles around

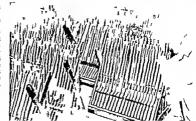
It was Garanda fertule brain that solved the difficulty Obtaining a bent heavy metal pipe the boys jugged it to a little hillock in the middle of a field. There they propped it up so that one end formed a bulls eye and the other pointed skyward. At 200 yards the boys drove their bullets into the open mouth of the pipe. The right



This is the borrel rilling section of the Springfield Moss. Armory where Gorand rilles are made for our doughboys. Big lathes tended by at lied craftsmen cut the sprial groaves inside the borrels.

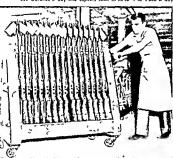


The flot's ded blank of Canad an black walnut in the hunds of the workman above will became a glassy brown rife stock Two round a ed p aces are seen in the mach ne in the photograph below racks of in shed stacks are wat ng to receive the burrels and mechan sms





Straightening a boire! Under a trained eye the machine applies pressure to correct slight imperfections. Springfield is turning out 500 Gorands a day and expects soon to roise it to 1,000 a day



Guns for thirty more soldiers a botch of completed offer in spected tested and tagged moves off to play its part in Uncle Sams to give the program. Selow Garand tooks on as Col G. H. Stewart commanding officer at the Atmory examines the poduct



angle curve sent the lead streaking toward the strato-sphere. However its ear splitting zung' resounded over the countryside and farmers who were convinced a built had just missed their cars came dashing up in bug complaints. It usually took a long argument and a couple of demonstrations before they were satisfied.

By the time he was eight seen Garand was a full fledged machinist at the tex tile mill. As a side line one summer he and his brother ran a shooting gallery at Norwich Conn That was a lot like a boy with a sweet tooth managang a casdy after Their enthusiam for target practice at up most of the profits.

under production of the control of t



like to whirl and spin on skates, but be doesn't have time to practice. In spite of such varied hobbies, he always kept coming hack to firearms. They formed the center of his interest.

In the early days of the World War, Garand came to New York, working in a micrometer plant in lower Manhattan Saturdays invariably found him alighting from the subway at Coney Island with a target shootare light in his eye. He was star patron of all the galleries along the hoardwalk Wages were good, and he shot to his heart's content When he moved from one gallery to another, a queue of onlookers trailed hehind One Saturday, when he was finding out about rifles by using Coney Island as a laboratory, he shot at every target there By nightfall, he had set an all time high for himself, not only in score but in expense as well. He had spent \$100 at the galleries in a single day

Luckity for his bank halance, he discovered a gallery near Times Square, about this time, where the proprietor would let him shoot free Firing a rife from the hip so accurately that he could hit a swinging target seven times on a single swing, he always attracted a crowd that overflowed onto the sidewalk and kept the cash register ringing at the sun counter.

During this period, when Garand was runling the World War a close second in booming the stock of ammunition makers, be was taking correspondence courses, studying lights to complete a formal education that had stopped when he was twelve One evening, hefore he sat down to his lessons, he read in a newspaper that the Government was having difficulty finding a satisfactory

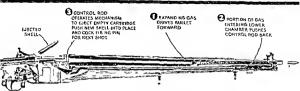


Before a new rifle leaves the Springfield Armory it must poss this firing test in the proving room

machine gum He couldn't see why there should be any problem about that, so he sat down and designed a machine gun of his own Folding up his drawings, he slipped them in an envelope and addressed it to the Naval Board, in Washington, D. C.

That act switched Garand onto the main track of his life work. It gave point and direction to his consuming interest in guns.

In due time, a letter came back from the Naval Board The experts were aufficiently interested in bis drawings to invite him to come to Washington for a conference The upshot of that (Continued on page 255)



This drowing shows how the Garond semiautomatic rifle harnesses the 'kick to load the gain for the east shot. The pressure of expanding gas which drives the builtel from the borret also operates the mechans in that ejects the empty shell and throws another cortridge into firing position. All the sadder has to do as to keep pulling the trigger

# New U.S. Stamps Honor Great American Inventors



CYRUS H MCCOHMICS whose invention of the resp ing machine helped pave the way for America great agricultural development was born in Walnut Grove Van 1809 His first reap ing machine was built in 1831 and patented in 1834 Grove the way of the respective of the resp



SAMUEL F B MORSE was a successful portrait painter before he invented the telegraph Born in Charlestown Mass in 1791 he studed att after his graduation from Yale The idea of the telegraph oc curred to Morse on a voyage from Europe and the twention was exhibited in New York in 1855 In 1344 the first public message was sent, Morse deel in 1872.

**LIVE** great American



ALEXANDEN GRAHAM EELL JAHE OF the tele phone was born in Edinburgh Scolland in 1847 He came to Canada in 1870 and two years later became professor of vocal physiology at Boston University His telephone was demonstrated at the Philadelphia Exhibition in 1876 Bell was great ly interested in the welfare of the deaf and later in avlation He ded In 1822.



ELI WHITINEY revolution rized the South ectton in dustry with the invention of the cotton in dustry with the invention of the cotton in Born in Westboro Mass in 1765 he was studying law in Georgia, when he was saked to de velop a quicker way to sep arate the cotton fiber from the seeds. Using tools of this own making he produced the guning machine which was patented in 1794 Whit-Pey dief in 1829.

inventors are bonored in commemorative stomps just assued by the U.S. Post Office Department in the Fo mous Americans Series Eoch stamp bears an unfromed portrait of the inventor whose nome appears on a ponel in the lower left corner with the de nomination and a de vice representing a coawheel, uplifted wings, and a lightning flosh — symbolizing power, flight and elec tricity Edison is not in cluded, as a special stamp in his honor was issued recently



ELIAS HOWE gave us the sewing machine Howe was born in Spencer Mass in 1819 Although his look-stitch sewing machine was patented in 1845 he had directly in getting his invention accepted and then in fighting infringements on his patent rights After a long series of court battles he won out and made a large fortune Howe died in 1867

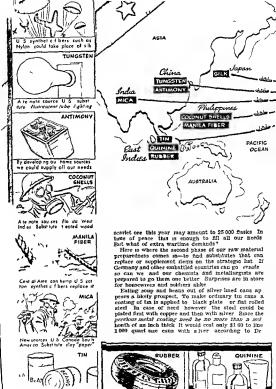


# MOBILIZING MATERIALS

By ARTHUR GRAHAME

A TELFPHON'S bell rang in the office of Fdwarl R. Stettlnius Jr chief of the National Defense Advisory Commission s materials division. It was the Chinese Embassy calling A sizable quantity of tungsten had just become available in Indo-China. Would the United States be interested?

It most certainly would Three calls by Stettinius brought quick results The Reconstruction Finance Corporation would supply fun is for the purchase The Procurement Division of the Treasury would instruct one of its agents to do the buying The



Ame commonulacture scan make Synthetic preparations can re synthetic subber from pet aleum place quin ne for med cal use



itary vehicles may soon be rolling into hattle on three made from
the same raw material that provides finel for their carburders
as 30-000 program for expanding experimental synthetic
rither factories into big mass production plants has already been
initiated the National Defense Advisory Commission reports
But it takes precious months to develop rames and to get new
factories into production. In a national emergency could we do

Hut it takes precious months to develop raines and to get new refectores into production. In a nat onal emergency could we do it in time? To tide us over that critical period while war in dustries are getting into high gear the third and most in mediately important part of our strategic material program is being but into effect

being put into effect
Gigantic piles of imported war metals and other supplies
are being laid in by Government agencies and stored on military
reservations for fire use only Kept intact unless war comes
they would then be thrown into the balance while new sources
were catching up with military demands.

Beginning last year the United States has been stocking up heavily on burty seven strategie and near strategie materials Its fast growing reserve of manganese intended to fill all war inten needs for a year results from orders placed in India Africa Chile and at home The Anaconda Copper Company has contracted to furnish 80 000 tons a year for three years from its Emma mine in Montana A rising pile of chromium results from orders placed first in Turkey and Alaska Wherever possible contracts have been awarded to foster development of United States and Western Hemisphere sources at the same time urgent needs must often be filled from far away countries. Huge laternational cartels have contracted to furnish us nearly a

Glowing mother metal gushes from an open hearth furnace to fill ingot molds as America's sheet industry works a ght and day on detense orders

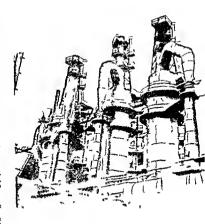


year's supply of vitally important rubber and tin

Odd items appear in some of the orders—for instance toms of quinne to ward off disease it our soldiers operate in the tropics Quartz crystals will be needed to keep radio transmitters on the right frequency in an emergency they could be flown by plane from Brazil but the United States forehandedly laying in nearly for storage

Novel commercial arrangements have been con cluded and are under ne gotiation We wanted 85 000 tons of British rubber The English wanted 600 000 bales of American cotton It was a deal Despite war difficulties a large propor tion of the rubber has been delivered At this writing the United States and Great Britain are working out a plan to store 200 000 000 to 200 000 000 pounds of Brit ish wool in this country subject to purchase for the If S Army in case of war Then it would be made into Army overcoats and

blankets
So far the story has been
of America a weaknesses
and their cure With these
headaches off our mind we
can settle back and com
fortably reflect on our
strong points No other
country in the world can

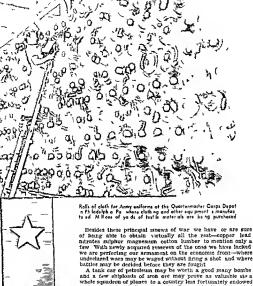


Blast furnaces I to these at Gary Ind are going full blast Steel is the back bone of any armament program and we have the makings of steel rail and coal

books such an enviable assortment of natural resources at home Food most essential of all raw materials un war or pêace isn't one of our defense worries. We raise more than we eat of almost early important foodstuff from apricots to wheat. We tour have to choose between cannons and butter—we can have all we want of both. If war should come mild rationing of sugar and coffee might be necessary. But our ability to import large quantities of both commodities from Latin American countries bordering on the Caribbean probably would avert even that mognateplace.

Steel is the great essential of armament and iron and coal are the principal raw materials used in steel making. We have enormous reserves of both and can easily mine enough to meet even the tremendous demands of all out warfare

War in the air the use of oil as fuel for modern fighting ships and mechanized warfare on land have combined to make petroleum an imperative military necessity. Our resources greatest in the world will fail all needs for oil and leave an ample supply for making synthetic products Large stocks of the comparatively new 100 octane aviation gasoline are being accumulated and stored for Army and Navy air forces.



of being able to obtain virtually all the rest-copper lead nitrates sulphur magnesium cotton lumber to mention only a few. With newly acquired reserves of the ones we have lacked we are perfecting our armament on the economic front-where undeclared wars may be waged without firing a shot and where

and a few shiploads of fron ore may prove as valuable 13> a whole squadron of planes to a country less fortunately endowed with raw materials than our own Conversely the nation that has them in sbundance is in a commanding position to bid for international advantages and to wage war or put a brake on it.

The United States embargoes shipments of aviation gasoline outside the Western Hemisphere-ostensibly to conserve our supply but incidentally denying it to militant Japan. We lend China \$25 000 000 to be repaid by future shipments of tungsten As Japan gobbles up French Indo China America cuts off vital Japanese supplies of scrap iron for warships and armament To make Brazil independent of Europe for heavy steel U S experts and a \$20 000 000 loan will help build the largest steel plant in South America-freezing out Krupp the great German armament concern and other foreign interests

In tense dramatic moves upon the chessboard of international politics raw materials will continue to make big news Even in peace America's wealth in them plays a powerful strategic role. And in war you can strike an enemy as effectively with a lump of manganese as with a bayonet.



## "Night Glasses" Train Soldiers To Fight in the Dark

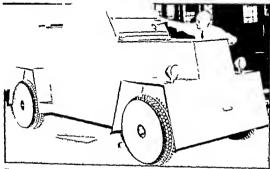
FOR practice in fighting in the dark cadets in a British officers training unit wear special night glasses during day time maneuvers Fitted with dark lenses the glasses reproduce the visibility conditions that would be encountered at night in

this way the young soldiers learn to recognize the landscape as it appears in darmess and acquire skill in taking pot shots when they cannot see their rife sights. In the photograph above several cadets are using the glasses which turn day into night.

# Bulletproof Body Turns Any Auto into an Armored Car

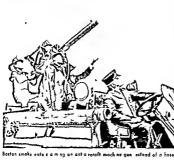
EVERY automobile in the United States is potentially an armored car under a plan recently proposed to aid the national de fenss program. The scheme would provide tankitike bodies of half incb steel which could be speedily mounted on the chassis of standard cars. Swarms of these minute man tanks the proponents claim would prove an invaluable aid in combating in vaders and parachute troops

81



This immute man tank was made by mounting a body of half natisteel on a standard automable chass s

### Firemen Learn To Fight Air Raiders as Well as Fires



engine smoke eaters of Boston Mass recently demonstrated how their force could cope with an enemy air raid Now plans are reported to arm a number of other fire trucks similarly and to train gunners with the cooperation of the National Guard. In case the firemen were attacked by low flying raiders while putting out a fire started by air bombs the powerful machine gun would provide an effective de fense Other engines roaring along highways with airens ahrieking would serve as mobile antigircraft units ex clusively aupplement ing the work of regular military defense units

By MOUNTING an anti aircraft gun on a fire

# Concrete Pill Box or Bomb Shelter Is Built in a Day

CONCRETE pill boxes may be erected in a single day by a speedy new method ex hibited to War Department observers at New Haven Conn The structures may be used either as fortresses or as bombproof

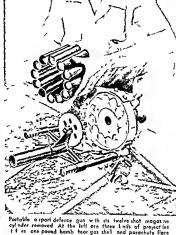
shelters during air raida. A biscuit shaped design found most autable for the purpose shown in the illustration below measures fourteen feet in diameter and has walls a foot and a half thick



In an emergency structures the this can be exected quickly for use by either soldiers or civil ans

### All-Purpose Gun **Guards Airport** from 'Chutists

SPECIALLY designed for de fending military airports against attack by enemy parachutists a portable all purpose gun tested recently at Floyd Bennett Field New Lork City fires tear gas and smoke shells parachute flares and one pound fragmenta tion hombs Projectiles are placed in a twelve shot maga zine resembling a revolver cylinder which can be changed in three seconds for reloading Weighing only forty pounds the versatile weapon has a barrel of 11/4 inch bore and can be folded up quickly for carrying It is believed that a few of these guns could ward off any parachute attack





The 1/2 nch weapon set up for act an Weighing only forty pounds t folds up quickly for carrying



# Soldiers in Overalls

KEEP OUR WAR MACHINE-ROLLING

A RAIMY officer who has what it is also can make be deal tired men march all the can make save as the can make save at stranger of the morning and he can make saved attirungs fight and win when the code are all against them That a leadership—the most valuable deality that an officer can have But even be best broken tracks or per intelegre out of a car with a cracked eyinder. It can t grind the values of an ammunition truck repart a broken down machine gun or weld the cracked axis of a howster. Those are jobs for trained and shitled mechanics—for the fighting machines running

While our Army still is dangerously short in the quantity of its mechanized weapons it is long on their quality. Our light tanks developed by the Ordanate Department are rated the world's best. They have better engines better drives better transmissions and better tracks than any other light tanks they are beaver faster and steaders gun platforms. When it comes to the quality of their fighting vehicles and their gys.



tem of keeping em roiling our mechan ized soldiers don't have to take off their snappy barrack caps to any army in the world

One of the purposes of the Third Army maneuvers in western Louisiana this spring was to give our Regular Army officers their first large scale opportunity of practicing the tactics and solving some of the problems of mechanized motorized and modernized warfare. The maneuvers also provided a stiff test of the Armys services of main tenance and supply. The minite war meant two weeks of the hardest kind

meant two weeks of the hardest kind of work for the 70 000 Regulars who took part in 1-especially for the men who had the job of keeping roll ing the over 7000 motor whiches which were driven hard both on the roads and off them There was plenty of sweating done—but then as

or sweating done—but then as China's General Chiang Kai shek says the more you sweat in peace the less

you bleed in war

Following the light tanks of the Mechanized Cavalry Bigade—then the most thoroughly mechanized out fit no our Army—as they thundered over the big maneuvers area on their secouting and combat missions I was able to get a close up of the operation of the maintenance system of an or ganization which had 720 vehicles on tracks and wheels—tanks secout cars.

half tracks trucks passenger cars and motor cycles—and which regards attack lag at daybreak 150 or 200 miles away from where hostile aviation reported it at dusk as just another routine job

Each troop has a maintenance section which stays with it under all conditions to make minor repairs both on the road and on the hattitefield It is commanded by a motor sergeant who is an expert trouble shooter and travels in an armed scout car followed by a truck which carries light repair equipment a small assortment of spare



a tactor s all n fine days wak fa feld mantenance men Spare parts and all necessary tools and equip ment are carred

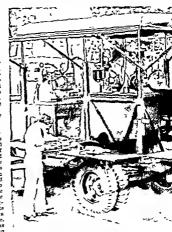


A welding truck halts to repair the corriage of field gun, its generator provides current for welding and to drive its Dover tools. At right an automative repair-shap truck

parts and an emergency
supply of gasoline and of
When a tank or scout car
is disabled it is pushed over
to the gode of the road
and the rest of the troop
goes on forward to sight.
It is an unbreakable rule
that the officer in com
mand must not wait for
cripples.

When the troop main tenance ection comes up the motor sergeant checks the disabled vehicle and diagnoses the trouble If be has the time and equipment for the 10h he makes the repair, takes the vehicle along with him to the next half, and then sends it forward to rejoin the troop If he can't make the repair he tags the job with his diagnosis, and leaves it. Its crew always stays with a disabled tank or scout car. so that as soon as it has been repaired they can take it back into action where it Delongs.

Following the regiment on the march as the regimental maintenance section which carries with it a larger assortment of sparse parts and is equipped to handle jobs such as changing tank tracks and installing new shaft assemblies. When it comes up to a



disabled fighting vehicle the staff sergeant and is still cheef mechanic rechecks the job, and if an immediate repair is practicable leaves a crew to make it. If a roadsude repair cant be made he has a wrecker tow the cripple to where the regiment is going to knowac for the night and the

repair is made there. When the re is fight ing going on a regimental service park is established a few miles back of the combat zone. Disabled vehicles are reported to it by radio and crews are sent out to repair them on the battledeld or to tow them in

Jobe which are too big to be handled by the regimental maintenance sections are taken over by the brigade's ordnance maintenance company which has machine sho trunks welding apparatus and other equiment which while stury's light enough to be carried in trucks. This organization can handle almost any repair job even that of installing a new engine. It takes with thin the field two complete engine assemblies for each fifty tanks. Its 209 odd birthly trained soldier mechanics set in their shop in a big square tent brightly lighted by electricity supplied by a genera tor truck Often they work all night to make good on their boast that if it is humanly possible they always have every disabled vehicle ready to go when the column muits out in the morning

There will be one of these maintenance companies probably increased in man power in each of the two divisions of the new Armored Corps now being organized Men now are being trained to do this specialized mechanical work of the Army's most modern fighting outfit at schools for cently established at Fort Enning Ga and Fort Riley Kans

As important as keeping a mechanized force s fighting vehicles in perfect mechan ical condition is the job of keeping them

supplied with fuel There s nothing in war more useless or more helpless than a tank with an empty gas tank Having a supply of fuel at the right place at the right always demands moment careful planning and often demands hard work Tank trucks have been tried and discarded Now cargo trucks carry the fuel in ten gallon cans which while the column is halted are dropped off at each vehicle This method saves time and time is the



Inter or of a small arms
repart uck which keeps
riles patols and ma
chine gunz nigood order



The Quartermatter Co ps handles the big tob of feeding gotale to the war machines. This is a feld depot whe of fuel is put into ten gallon cans for distribution by tuck to hungry tonts and tractors.

determining factor in to day a warfare

Attached to each of the two army corps we now have organized there is a corps ordance that the station and equipment is being procured for additional battailons so that as the expanding Army adds new corps there will be a battai on for each of them

Each man in these bat tailons is trained to ex pertness in some me chanical operation After he has mastered that part oular job he is trained to handle other jobs All the equipment is carried on trucks and most of it is used on them so the field shops

ars ready for work a few minutes after the trucks have scattered through some patch of woods which will give them cover against at stacks. Included in the equipment are field welding outsits machine shop trucks and special frearms repair trucks which carry sxtensive assortments of spars parts

and special firearms repair trucks which carry satensive assortments of spars parts and the tools necessary for the repair of machine guns rifles and pistois One of the jobs I watched being done dur

THESE TROPES AND A 55 AND A 50 AND A 50

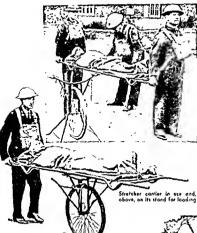
Uncle Sams I ght tanks are gene ally rated the best in the wold. The automay view shows one of them with its four manic ew at its post

ing the Louislana maneuvers was the weld ing of the broken axie of a 155 millimeter howitzer without taking the big weapon out of its firing position

In its various post shops the Ordnance Department has sturdy but comparatively light machine tool equipment capable of doing all the work of a large job shop. In war this would be taken into the field and used by ordnance (Co tinued on page \$23)



Trucks and other nonlighting webicles are kept in running a der by the Mota. Tonspait Service



# Stretcher Holder With One Wheel Speeds Rescues

Ove man can trundle an injured person to an ambulance or first-aid station on a one-wheel stretcher carrier designed for use in air raids Built to fit a standand stretcher, the device uses a bicycle wheel and has a stand to support it when the stretcher is removed. Since it can be operated like a wheelbarrow, the carrier enables a single worker to take the place of two men in moving bomb victims, speeding rescue work in cases where ambulances cannot be brought right up to the scene of the damage, or when a first-aid station is set up near-hy.

# Mass-Production Air-Raid Shelter Made in the U.S.

APPROPRIATELY shaped like an Indian tepes, what is said to be the first bomb shelter to be produced commercially in the United States was placed on display recently at Ouncy. Mass. Made of quarterinch reenforced steel, the pyramidal hide out is not intended to withstand direct hits, but is said to be capable of protecting five or six occupants from flying debris. Mass production may soon be started on the shelter, which is a copy of a popular-priced English model that has proved very effective,



ty fent, but a demonstration model of an American bomb shelter
MILITARY

# **Squadrons Right!**

# HOW WARSHIPS MANEUVER IN BATTLE

HEN the cracking rade report from advanced scouting ships or planes sends a battle fact out to sea in search of the enemy how does the Adm ral handle h s floating fortresses? How do they advance nto bat

e What format ons do they take and what ma neuvers do they follow?

As far as they relate to Amer cas m ghty arma da detailed answers to these queres are the realously guarded secrets of the commanders who have been putting our battla forces through the r paces in long drills at sea No one outs de of offic at c relea knows tha spec fic maneuvers that the U S Fleet w !! fol low f t s called upon to steam seaward to prote t our coasts or repel a threat d rected at the Panama Canal

But certs n format ons andmaneuvers are stand ard among all navies only the combinations and elaborations of them for specific purposes being kept under cover. In the words of Winston Church II two Frst Lord of the British Admirally The evolutions of cavalry in the days of

shock tact cs and those of a modern fleet re semble each other

semble each other both cavalry and fleet dr II cons to pr marrly in swift and well executed changes from one forma t on to another

The base tactics he cont nues call for a fleet to approach na compact mass and then deploy into a long column to fight so that all guns can ba trained over one s de for a withering blast at the enemy Thed agrams on this and the following pagea Illustrate some of the major format one and maneuvers used by battla fleets to gain a tact cal advantage over the r op ponents in the deadly game of war at sea



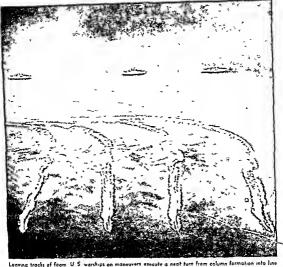
# iliese are suandard grusiko

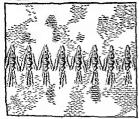


SHIPS N COLUMN in a few botte this famation enables of the hips to bing the bood destables simu aneou yee the enemy



INE OF BEAR NG 45 DEGREES. He e the shp are aleaming on para er cours with ace end of the line far and once of the other





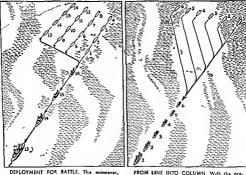
SHIPS IN LINE, or line of bearing 90 degrees. This formation can be used for approach, but it would be fatal to be cought so under fire



COLUMN OF DIVISIONS Here the fleefels' steaming in column of fours. It can easily swing into a single column, as shown on the next page



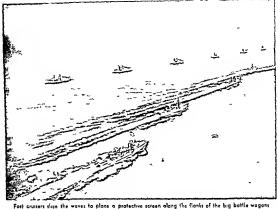
Seen from the sky through wisps of cloud, three columns of ships symbolize America's growing see power

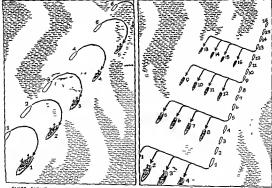


DEPLOYMENT FOR BATTLE. This moneuver, for bringing ships into single column was used by the British at the Battle of Juliand in 1916

92

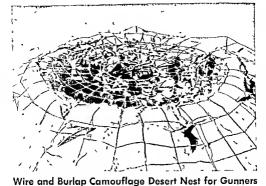
FROM LINE INTO COLUMN. With the precision of a football squad executing a signaled play, the battle wagons wheel into their places





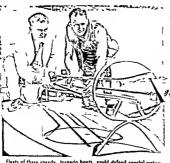
SHIPS RIGHT ABOUT This is a quick way to reverse the direction of a column of ships Each vessel turns sharply and falls into place

COLUMN TO COLUMN OF DIVISIONS To make this change of formation the ships of each division swing out and form into a line abreast



# BLENDING into its desert background the circular post concealing the light rapid fire

British Bren gun post pictured above serves both as protection and as camouflage Lo cated somewhere in the Near East the gun is made of piled sandbags covered with a spider web of cords on which shreds of burlap have been hung for concealment



Fleets of these speedy torpedo boots could defend coastal waters

## Tiny Torpedo Gun Arms Outboards for Coast Defense

Tivy torpedoes can be launched from the decks of small outboard racing boats by means of a novel device tried out recently the boat deck can be a south of the boat deck can be a south out to be a south out t

operate number steel track among which the torpedo is propelled and launched in to the water by powerful coil springs. Hundreds of privately owned outboard boats it has been suggested could be equit ped with the torpedo throvers to form a potent emer gency defense fleet if r the protection of coastal grade.



# "Chess Game" Directs Air-Raid Defense

LIKE players at a giant chessboard offi ers at the air defense control center seen in the unusual photograph above are ploting the moves of hostile aircraft. Through eadphones plotters seated around the ble map receive reports of undentified anes and formations from field observa tion posts and mark their positions and courses with counters. Supervisors wield ing wooden rakes rearrange the counters to form a complete picture of the general situation Observing the map from a platform in the rear tellers telephone information to air force commands.

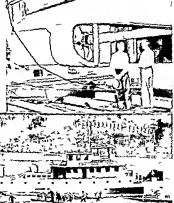


## Vest-Pocket Respirator Guards Workers' Lungs

SMALL enough to be carried in a vest pocket a one ounce respirator protects industrial workers against dust with new convenience. The un breakable soft rubber device covers the nose alone so that a wearer can talk eat smoke and don glasses or While the user breathes gogeles naturally through his nose an in genious valve exhausts stale air and allows only filtered air to enter A) though the replaceable filter folds to wafer size its effective area of nine square inches assures easy inhalation Elastic car loops hold the respirator

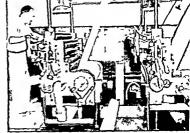
# Propeller Tunnels Boost Power of Ohio River Towboat

REVOLVING within tun nets of novel engineering design twin propellers of the Wheeling Steel Corpo rat on s new 135 foot tow bost Ductillite propel it with heightened effic ency Tests are said to have shown a thirty percent boost above the normal push of the ship a two 760 borsenower Diesel engines The ultramodern river craft will be used to tow coal harges from Harmar vile Pa mines to near by steel plants on the Onto Piver The novel vessel was launched a deways off the bank of the river



# Rubber Plates for Rotary Press Speed Up Printing and Cut Costs

ORINTING plates made from a specially compounded rubber are a new development that is expected to speed up the print ing process and at the same time cut down its cost. With the new process type is set by hand or machine and then transferred to a plastic matrix or mat, by means of a hydraulic press The rubber printing plate is then made from this mat First a sheet of the special rubber is placed in contact with the type marked plastic mat Next a sheet of spring brass is placed over the sheet of rubber Then the combination is placed in a powerful hydraulic press for a period of five minutes. The result is a rubber printing plate vulcanized securely to a spring brass backing This combina tion can then be bent around the cylinder of a specially designed rotary press for high speed printing According to the manu-facturers the rubber printing plates have many advantages They print clearly at all times even the finest type losing none of its definition They wear long er than metal plates having shown little wear after special tests when they were employed in making as many as 200 000 impressions The rubber plates can be used to reproduce line drawings or half tones if spe cially prepared The plates cost about the same as electrotypes or offset plates but they reduce printing costs due to the in creased speed of rotary press printing and to a saving in the cost of making plates ready for the press Because of their af finity to ink the plates are said to print with less ink than metal plates Duplicate rubber plates can be made from the plastic mat in only five minutes



Outlasting metal plates brass backed rubber plates on the roll ters of this special press will print over 200,000 impressions

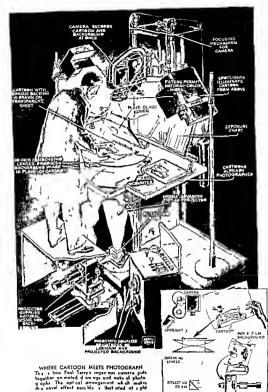


From a plast a mold made from convent and type on impress on is court to be taken on a rubber plate under pressure and heat



Removing the tubber plate with its spring bross back from the plastic matrix list flex billy is evident and it may be easily mounted on the rotary press Belaw the materials Special plastic plastic matrix the original type and the finished plate





PROJECTOR

98

# **New Cartoon Camera**

# COMBINES DRAWINGS AND PHOTOGRAPHS

REAL car with a flesh and blood driver rolls sedately along a busy city street Carcening behind it a carneature of an indian in a speeding fullopy performs anties that would whit an the hair of a traffice op Trick photography produces animated movie carteons of this novel sort combining hand drawn characters with natural backgrounds in the studio of Paul Terry at New Rochelle N \(^1\)

In making the 6 000 separate cartoons that go into a typical 500 foot animated film the artist uses a special procedure. Each figure or object is drawn on top of an opaque silhouette of black or white pigment applied to a transparent sheet of cellulmad.

Hold it up against the light and you will see only the black outline of a figure hy reflected light its details appear. So each cartoon receives the Illumination of a pair of spotlights from above while a stop motion camera photographs it Meanwhile the opanue cartoon effectively blocks out the unwanted part of a real movie scene which is projected from below through the transparent part of the celluloid The rest of the background automatically is photo graphed with the cartoon giving a com posite picture For each succeeding frame the same procedure is used after cartoons and background scenes have been shifted Simple as the scheme may appear in







The new system creates oweer scenes like this

principle its practical realization required an optical set up so original that it has been awarded a patent. To match the size of an artist a drawing hackground pic tures on standard movie film had to he greatly enlarged Through the reflecting prism illustrated-which simply serves like a mirror as a space saving device-a projector could have thrown the film image upon a screen of ground glass. By scat tering the light however the screen would make the system relatively inefficient and Therefore Terry substituted n huge pair of nineteen inch condensing lenses the most costly part of the whole appara tus for the ground glass They form a brilliant invisible image which can be seen only by the camera's lens or by placing the eye in exactly the same position unless a translucent screen is temporarily inserted for focusing Since this back ground image can be adjusted to fall ex actly at the level of the cartoon the camera easily brings both to a sharp focus Light regulating controls adjust the illumination from spotlights and projector until they halance and all is ready for picture making

Rapid and economical the new process will make animated cartoons either in hisoke and white or in full color. For the latter purpose a set in cloir separating filters or cupies a rotating mount over the lens between the cloir drawing with its corresponding hackground of color film is then phontographed through each filter in turn.

# Hollywood Moves



what nature requires two generations to accomplish, nurserymen and movie studio workers recently trans planted a forest of pine trees from southern California mountains onto the Paramount studio lot in Holly ing in twenty four hour shifts cut the trees and in 100 truck loads dispatched them down a winding mountain road from Arrowhead to the movie capital. Larger than any trees ever to ride the highways they measured up to ninety seven

nursery concern faced the unusual ly difficult problem of lowering the trees 600 feet down a steep moun tainside and delivering them on the set without breaking their hranches



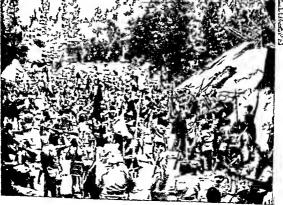
# a Forest

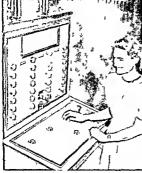
for ful color scenes in North west Mounted Folice. He surceeded by skidding them to the waiting trucks on an elevated cable way then blocking them up on the truck floor over an inverted V made of timbers Although some trees overhung nearly fifty feet, few branches were lost.

Carpenters erected the movie forest by placing each tree in a huge wooden Christmas tree stand Some of the trees stood on a synthetic hill made of wood and plaster Others were planted on top of sound stages and a water tower both to hide the structures and to give the illusion of distance The set covered nearly six acres Hundreds of tons of earth were moved to create the uneven forest hke terrain Forest rangers were stationed to guard against fire

Among abstacles to moving the trees was this steep mountoin highway down which they we e successfully brought







Playing the ancient Chinese game of is m with the much ne

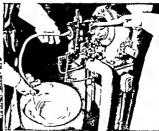
# Playful Machine Is Hard To Beat at Own Game

A PLAYFUL, one ton electric brain exhibited by Westinghouse engineers challenges all comers to the ancient Chinese game of him Red blue yellow and green lamps extinguished by pushing buttons replace counters drawn from stacks in the original game. A player first turns out as many lamps in one row as he chooses. Then the ma chine operated by 116 relays takes its turn. This goes on until the ma chine or its opponent turns out the last lamp winning the game Since one wrong move means certain de feat a player has small likelihood of beating the robot by chance But he as sure to win if he can think fast and securately in what mathe maticians call powers of two of the binary system of numbers" The baffled automaton then pre sents h m with a pocket token

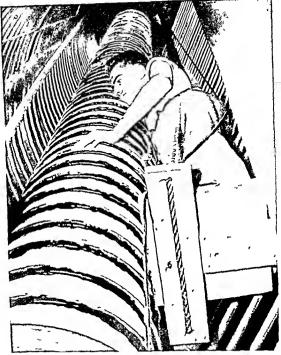
#### New Synthetic Rubber Is Made Directly from Petroleum

MADE directly from petroleum a new kind of synthetic rubber helps relieve U S dependence on fore gn sourcea for a vital raw material Named butyl rubber the product shown below in its

pecul arly shaped raw state has been placed in aemicom mercial production by the Standard Oil Company of New Jersey for auto tires and other purposes. From this and different types of syn theticrubber including Amer ipol Neoprene Koroseal Phofilm Thickel and American buna de fense experts now can choose a variety with characteristics best suited for the par ticular use to which it will be put



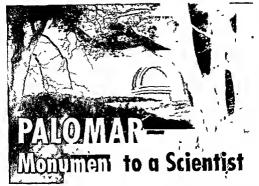
Looking like heads of coul flowe the row butyl synthetic rub her a shown of left Above a machine converts tinto tubing



### Giant Atom Gun Gets Final Check-Up

F YOU think this man is putting an enor mous stack of pies into an oven you re mistaken Actually he searching for any possible leaks in one of the world's biggest vacuum tubes At its top by means of a glow discharge a new University of Penn sulvania atom smasher liberates electrified

particles of heavy hydrogen or helium High voltage electrodes hur i these bullets downward through the cylinder When they hit the material chosen for the target at the bottom they are traveling at speeds up to 18 000 miles a second! A near by tunnel offers observers a refuge from deadly rays



Fom a Book The Ga Ga of Fooms

#### By DAVID O. WOODBURY

CEVENTY years ago the great romancer Julas Verne, told of a mountie reflective telescope which would follow the fight of a projectile fired from the earth to the moon Twelve years ago Dr George Ellery Hale to inder of Mil Wilson Observatory in Call formia improved upon Verne a prophecy in the design of a 200-inch telescope. Today a mile above the Pacific on the top of Palomar Mountain this flass quant is nearing com pletto: Soon its great aluminum coated mirror u Il be turned upon the heavens dragging billions of now invisible stars out of obscurity It be jun as one man a dream It will stand as a monument to that dream and that man

HE story of the glass giant of Palomar goes back to the year 1881 George Hale the tbirteen year old son of a well to-do manufacturer of elevitors in Chi cago III had decided to build a telescope HIs father gave him the money willingly and he hurried of to buy a small zens which he mounted in a homemade tube it was a pretty crude affair but it decided his career He would be an astronomer

A little later he heard of a telescope with a four inch lens that was for sale second hand. He explained to his father that he wanted to study the spectrum of the sun The elder Hale again put up the money and George mounted the instrument on the roof of the family residence.

In his freshman year at the Massachusetts Institute of Technology young Hale made arrangements with Director E C Pickering of the Harvard Observatory to take care of some of the instruments and use them when the astronomers d d not want them There he got his first actual training in the ob servation of the heavens. Almost at once his vigorous young mird struck off into ploneering territory By the time he was a numor he had invented an important new astronomical instrument the spectrohelio graph which photographs the sun by the hight of one chemical element at a time It was not until two years later after he had graduated and was installed in a back yard observatory of his own which his father had built for him in Kenwood a suburb of Cbi cago that he was able to make his innova tion work satisfactorily With the aid of a nineteen year old photographer named Ferdinand Ellerman Hale was able to photograph for the first time in history the tow ering flames of the prominences shooting 500 000 miles up from the solar rim



DR GEORGE ELLERY HALE father of the three greatest astronom call observator as in the world—Yerkes Mt Wison and Polamar. At the time of his death in 1938 his last and greatest achievement the 200 inch telescope at Mount Polamar in Californ a was well an the way to complet on

In the same year the young astronomer was married His wedding trip carried him to the Lock Observatory in California. Soon afterward he writed Europe and found the fame of his spectrohel ograph had preceded him At twenty three he was already con sidered an authority on the sun After a year abroad spent principally studying in Berlin under Helmboltz Planck and other famous physicatis he returned to Checago

Although he was then only twenty four his friend President Harper of the newly founded University of Chicago made him associate professor of astrophysics. It was not long before George Hale and Harper were deep in plans for an observatory big enough and complete enough to carry the astronomer a researches to their logical con clusion. The little twelve inch telescope in his Kenwood observatory was satisfactory only for preliminary atudies. He had been deeply impressed with the thirty aix inch instrument at Lick It was then the world s largest and Hale had come home with an ambition to own one like it. Once provided with a large telescope he could indeed lead the world to something new

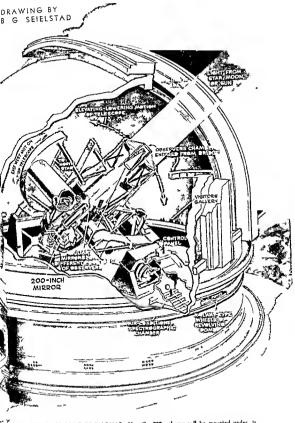
ABOUT this time Hale attended a scien tific meeting in Rochester N Y Pure ly by chance he overheard somebody talk ing to the great lens maker Alvan G Clark Clark was in a quandary The University of Southern California was spousoring a echeme for outdoing Lick and building a telescope even larger than the thirty aix inch instrument. After two huge forty inch disks were in Clark's workshop ready for grinding word came from California that an expected gift of money to pay for the Jens The University was not forthcoming couldn't even pay for the glass. Clark was out of pocket \$20 000 and as there was no one else in America who could possibly af ford such a telescope the great disks were

likely to be left on his hands orphan Hale rushed back to Harper with it news Ready to their very hands he sai were glass disks large enough to make it most powerful telescope in the world Bi where was the money to come from?

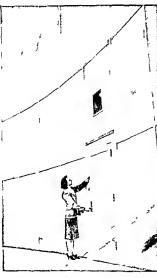
What are you going to do? Harpi asked

See Charles T Yerkes said Hale Yerkes was one of Chicago s most wealth men-and most influential. Hale laid h plans carefully. He got himself invited to dinner that Yerkes was to attend and con trived to sit next to him Then he bega talking astronomy Yerkes soon became fascinated This young man with his vivid interest in the stars was worth investigating Before he knew it he had admitted to Hale that he had dreamed since hoyhood of building the biggest of all telescopes Hale left the din ner with Yerkes check for \$20 000 in his pocket to buy the Clark glasses and his promise of enough more money to make them into a forty inch lens In the end the financier contributed a total of \$349 000 to complete the famous Yerkea Observa tory on the shore of Lake Geneva in Wisconsin

It was his father who had provided sympathy and help so many times that contributed another stride to his advance Even with the Yerkes Observatory Hale realized that he needed an instru



THE GLASS GIANT OF PALOMAR How the 200-nch eye will be mounted under is huge shell taller than a fifteen stoy building atop a mountain a mile above the sea



Alum num walls and doors a e-part of the system that controls the tempe ature under the b-g-dome

ment more powerful than the forty inch tel escope to make the study of stellar e-olution effective. His father saw this quietly he wrote to a famous French glass maker and ordered the largest dusk he could turn out. When it arrived, a great slab of clear green glass eight inches thick and sixty inches in diameter he presented it to his son.

That slab of glass became later on an important aid at the famous observatory at Mt. Wilson. It was the first of the modern reflecting glants which have culmunated in the 200-linch instrument at Palomar The stty inch telescope went into service in 1908 Already Hale was busy with plans for

a 100 inch giant A campaign to have the Carnegie Institute of Washington D C, establish a solar observatory on Mt. Wilson had succeeded and an old admirer of Hale s, John D Hooker had promised the money for a new giant of the sky a 100 inch reflecting telescope

It was 1918 and the World War was drawing to a close when this huge astronomical eye made if a debut. It has remained for twenty years science are glitted wayon in the attack upon the stars then that Stale bad rauned men at Mt Wilson at Yerkes even at his own private observatory at Kenwood—bad carried on the details of solar study year after year When the boundaries of the

When the boundaries of the universe-as far as the 100 inch telescope would reveal them—had been explored, Hale now a man nearing six y came to the conclusion that there was only one course to pursue More light A larger telescope shill Thus it was that his long dream reached its climax in plans for the glass guart of Palor the glass guart of Palor

How the Rockefeller Gen eral Education Board in New York City allotted the sum of \$500000 for the Palomar project how the great glass disk in the face of stagger lag difficulties was cast at transported on special trains nursed through tunnels and down steep grades while crack flyers stood on the and ings to let it pass how the

ings to let it pass how the mountaintop observatory took shape to receive it—all this is recent history

When Hale passed away on February 21 1933 he left behind three of the greatest observatories in the world—Yerkes Mt. Wil son and Palomar—as his monuments

It is curiously fitting that the last and greatest of these monuments the observatory on Mt. Falomar was still incomplet when he died. Throughout his life new goals continually lay ahead Each achieve the continually lay ahead Each achieve the continual property of the continual



Not a new ant a reraft weapon, but an astronom col comera for photograph ng myste ious "zod acal light

# "SUN GUNNERS" USE ODD SOLAR CAMERA

A SOLAR eclasse had a new kind of photographic instrument trained on it last October when the apparatus shown above was set up in Brazil by Prof Charles H Smiley of Brown University Called a

Schwarzchild camera it was designed especially to photograph the mysterious zodiacal light around the sun Ordinarily this fast tillumitation can be seen only at that or the state of the morton. Its source is generally believed to be reflected sunlight from a cloud of me teoric dust extending outward from the unbeyond the earth. Hitherto astronomers had tried in vain to catch the mysterious light with cameras of ordinary types used in solar photography

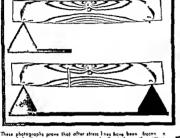
#### Wanted: An Electric Storage Battery Without Lead

WARTIME shortages of lead and nickel in Germany have inspired an effort to develop an electric storage battery that is independ ent of these materials and the German Government has offered a prize of 10 000 Re chemarks (about 34 000) for its inyen tion It is pointed out that the development of a satisfactory leadless battery would not only make it possible to meet the require ments for gasoline powered machines but also enable electrically powered vehicles to be employed for many purposes

# **Polarized Light**

MACHINES SAFER MAKES

Stresses set up when a so Irond toromet re wheel delvers dryng pressure on a rail are shown by the corved I nes in the plast a mod el below as they ap-pear by poloraed light



a sample by the new process even a saw out will not change the pattern

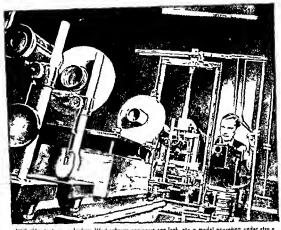


Racks l'he this hold frazen stress" samples for observation in the navel tests. The two creal fames hold disks of a light polarizing material

HROUGH a new technique called 'frozen stress," Westinghouse research workers can now look inude a piece of railroad track, a rear wheel a crane hook or a enuming shaft, and see the danger points that might cause failure in cervice. Like earlier methods used by stress engineers, it applies a peculiar and beautiful phenomenon

Viewed by polarized light, which vibrates in one plane transparent models of machine parts e-thibit rambow patterns of color when subjected to internal stress as by bending or twisting The various colors show the amount of strain much as contour lines indicate elevations on a map This scheme has worked splendidly with flat and stationary objects.

Now the Westinghouse 'frozen stress' method, for the first time makes it possible to peer into various levels of deep irregular objects by revealing the color fringes at each depth. In addition it simplifies the problem of observing stresses due to centrifugal force in rotating parts like the rapidly



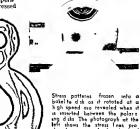
With this giant mag a lantern West aghouse engineers can look into a model operating under strain

spinning rotor of a huge electric generator Bakelita models pisced in an electric oven are loaded to simulate actual conditions and cooked for an hour st 240 degrees F Part of the Bake lite a sort of infusible skeleton of cells remains solid and bends normally under the load The rest liquefies within the cells. This fluid resin then solidifies as the oven cools to room temperature freezing the whole model in its stressed and deformed shape. The

model may be spun in the oven during heating and cooling with the same effect

The resulting test samples have the advantage of being permanent and easily han died requiring no further straining during examina tion Best of all they may be dissected like microscope specimens without disturbing the color fringe patterns Thus thin sections can be carefully sawed from the test sample at graduated levels and observed in order giving a complete three-dimensional picture of all stresses





duced in a crane hook under load

## WILLKIE OR ROOSEVELT?

HOW SCIENCE SPEEDS THE COUNTING OF 40,000,000 VOTES

UMMING over wires from every corner of the nation election returns in a few days will bring the answer to the question of America's 40 000 000 voters. Who s elected?

Years ago many data would pass before postive re suits of a Presidential election were known Today it is a matter of hours and minutes. To make this possible a scientific network of communication machines-teletypes telephones telegraph and radio-manned by an army of workers has been recruited and promises the earlest election returns in history But nothing will aid the vote gatherers more than the voting machines that this year number 35 000 in twenty two states

First used around the turn of the century the voting machine by reason of its speed accuracy and honesty has come up in popularity until this year it will tabulate nearly a third of the votes cast.

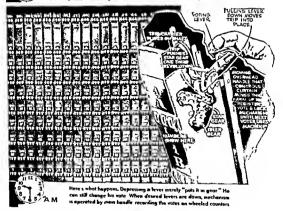
So you may see how modern high speed machines count the votes POPULAR SCIENCE selected a typ cal Mr and Mrs. America and in the series of pictures that follows starts you around the clock with them on Election Day and shows you how they may well know on the same night who s elected

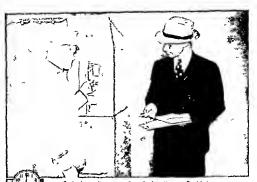


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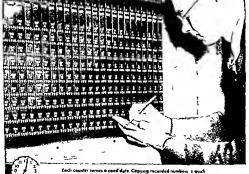


the curious ground him. To vote a lever over condidate a name is deressed. Rehaviors the handle records his vistes and reopens customs





Twelve hours after apening the pells close Here on afficeal lecks the mechine arguinst further vollag at the same hime unliecking the hinged back revealing the reves of volla counters you see below



Each counter serves a conditate Capying recorded numbers is quick and easily verified later as a master key in possession of only the election board chief would be needed to after the requisered totals



Palce carry cop as of the returns from polling places to local precincts thence to handquarters finally to the election boards for counting Presently incumerable local and state returns a e-totaled



DECEMBEP 1940



activities. He ante si eturns on a maste, chart judds them speed by and furn shes figures to ed to si who check scripts for the announcers

BLACK LEADING	ELECTION	CHART	Pro.	WINNER 5
			Mr. D	The state of the s
TS DIR! DR	DR M DR M	STATE NEL UT	DAI DR	E SENATE GOVER
		NEB 1 025	1:11	11-1-1-1
		NH 294 NJ 2577	-	
1		NH 3577	13	+1
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H	- n- 2	MA 1220		
		1-34	. 4	1
		1 H - 1 - 1		177
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	· 1 ( 1-	10 k 2	5	
	- 1		46	1-1-1-
	-	1 1 -1 -	50	1-1-1-1
10 2 Hs findings are also posted on this huge chart to ready reference				
of a st under after and assessed Village I should				

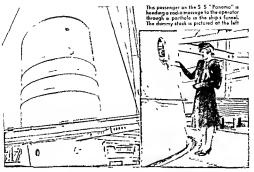
s the latest known esults



As early as this on election highly Groham McNamee, George Hix, and eithers of N B C's stell, and equally famed announcers an other realio chains, are breaking into the scheduled programs with election news



Just a few hours ofter the polls have closed Mr and Mrs America wat tensely bas de their home radio They IL, soon hear what they ve wanted to know far weeks and months. It is it Rogsevelt? It it Wilkie?



#### Liner's Radio Operator Works Inside the Smokestack

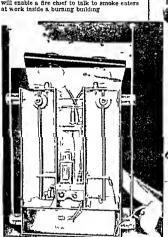
INSIDE the ship a smokestack is the unusual location of the radio room of the new American liner Panama While the funnel elliptical in section measures seventeen by thirty six feet a twelve-inch pipe suffices to carry off the smoke of the engines. The remaining space in the dummy stack is divided into three levels, the first of which contains the completely equipped radio room, a comfortable state room, a storage room for deckgame equipment, and a spiral stairway that serves as a short cut to the captains quarters On the second level, reached by means of a ladder. is a ventilator room housing engine exhaust blowers another story is a room where the ship a whistle may be reached for adjustment or repairs Portholes admit fresh air to the rooms within the funnel, which are reached through a door that is curved to conform to the exterior con tour In the photograph at the right, the Panama a Sparks is seen in his unusual quarters



ferior of the unusual radio room. The funnel alsa contains a oferoom a storage room for deck games, and the ships whistle

## Two-Way Firemen's Radio Is Carried on the Back

S A result of months of research work by two New York firemen Samuel Harmatuk and Arthur Meyerson smoke eaters in America's jargest city soon will be directed in fire fighting and life saving by means of lightweight, back nack radios Weighing only fifteen nounds the two way units can he slipped on over heavy fire fighting clothing ieaving the hands free for climbing A flexible cable controls the ountch which shifts the set from transmitting to receiving and back again The microphone is located on one of the shoulder strans of the harness and the earnhones of soft rubber can be worn under a helmet Tel escoping antennas are located on either side of the waterproof case which houses the set Power for the unit is supplied by dry-cell hatteries with a life of seventy hours. The specially designed condensers are not affected by heat During tests recently conducted by the New York Fire Department the sets proved they had a range of as much as a mile. In use they will enable a fire chief to talk to smoke exters



Fireman wearing back pack rad o. Note the microphone and switch cable attached to harness straps

Weighing only fifteen pounds the two way unit uses a regenerative circuit and is powered by dry cell batteries good for seventy hours

#### New Television System Transmits Images in Full Color

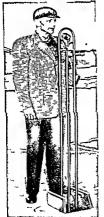


NATURAL-COLOR television long m the experimental stage may soon be on the air A new process devised by Dr Peter C Gold mark of New York and recently demonstrated by the Columb a Broadcasting System transmits color movies successfully next step will be lo adapt it to broadcasts of I ving subjects At the transmitter the image is scanned alternately on odd and even numbered lines Rotating color filters give the sequence of red green blue red green blue Thus two full color cycles serve for three pictures This allows t me for high defin tion scanning of 343 lines or more Viewed through synchronized filters at the receiver the pictures all ap pear in natural color since the eye retains one color image just long enough to blend it with the next two When no color filters are used with the rece yer the image is black and white

Television if onsmitter sconning colored moves. Below is the rece agand of the novel system







#### Basket-Shape Television Antenna Gets Broadcast-Power Tests

ASSAINO the stance of a butterfly collector about to pounce on be prey the eng neer atop the rad o tower above is up to more serrous bus ness. It's ring shaped implement measures the strength of rad o waves and the even queerer looking object in front of him is the latert in television autennas. By bolding the ring in vanous post ones and reading a meter on its bandle is testing the amount of power that the cagel ke serial radiates in different directions. Just perfected by General Electric engineers this common antenna has been erected at one of the company's stat ons near Schenectady N Y where it will be used for future piture broadcasts. The photograph also illustrates how a good television see commands a view of the horizon a good television see commands a view of the horizon.

#### Eavesdropping Mike Listens In on Umpire's Scraps at Ball Park

So that baseball fans may enseadrop on arguments between the ump re and players next spring a disappearing microphone bas been included in a new puble address system at a Wichita Kafas stad um Pressing a foot lever allows the incrophone to pop from its underground box near the home plate Through loudspeakers the spectators then enjoy the novelty of bearing what is going on In case a dispute becomes too hearing what its going on In case and spirit becomes too hearted for sens tive ears the mike hastily retreats As at left it may also be used for announcements

### **Torture Machines**

ALK along the creek of one of the many earth dams built by U S Army engineers through out the nation and you may wonder how grains of sand and silt and rocks can hold back flood waters. The answer is that every layer is subjected to a bat tery of torture tests by unitual machines which extract the innermost secrets of

Testing devices perfected in the Los Angeles Calif district drip water through various dam building materials compress others until they no longer can be squeezed smaller and shear tightly packed specumens until they spit

To small samples of soil devices called consolidometers which resemble large machine guns in firing position apply pressure equal to that anticipated in the dam structure. As the thickness dimin ishes micrometers indicate the change within a thousandth of an inch. Some of these machines apply losds up to twenty eight toos to the square foot move than would be exerted at the bass of Mud Mountain Dam an earth structure which traces 400 feet above the White River in the manifest of the results show how much the state of th

Will the foundation of a dam move under pressure? In the device below complex of soil are tested for resistance to shearing



A battery of permeameters, instruments that show how much water will seep through a given mate sal

## Test Soil for Big Dams

Permeameters receive samples whose density and weight have been recorded These devices consist sim ply of tubes into which soil samples are placed and containers permitting water to ooze through the samples By this means the engineers determine both the density required for various materials and the various parts of the dam to which they will be allocated Larger permeameters in the field take coarser materials in cluding six inch rocks

To determine whether foundation materials under lying the huge structures will move under pressure compacted samples are sub mitted to powerful shear machines Eachdoublehand-

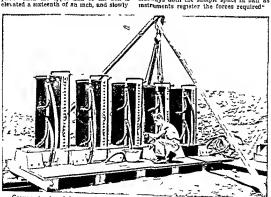
ful of soil is packed tightly in a double box For several days pressure equal to that sustained in the field is ap-

plied Then the upper half of the box is

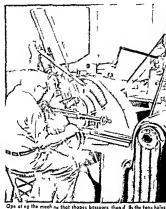


Putting the squeeze on zoils samples compressed in these machines reveal the extent to which a dam foundation will settle under load

while one hydraulic jack maintains tre mendous vertical pressure another shoves sideways until the sample splits in half as instruments register the forces required-



Caarse mater als including rocks are tested for permeablity in the field in large tanks like these



#### Odd Machine Makes First U.S. Bassoons

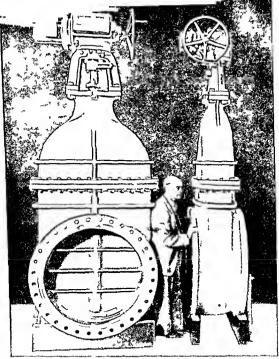
PRODUCED by the ne cess ties of war that has cut off the foreign supply of musical in struments the first ma chine made in America for turning out bas soons recently began funct oning in an Elk hart, Ind factory In prewar days these in struments were im ported from Europe Because the body has to be turned out with an oval shape and the tone holes must be drilled into the body at differ ent angles these in struments are hard to produce The Ind ana machine a combined lathe and drilling ap paratus speed ly turns out the body of the in strument and then drills the boles as required.

#### Rubber Tires Replace Iron Rollers To Pack Road Soil

BATTERIES of close set rubber tires are now replacing clank ng ponderous iron rollers in packing down the so I for new highways The specially des goed tires with smooth treads are placed a de by side m two series one just ahead of the other Their treads are staggered so they cover all the ground in a given strip Nine of the t res five behind and four in front, support the weighted framework of the novel roller



sa d to pack so I mo a affect vely than on rolle s



#### Giant Valves Made for Biggest American-Built Liner

WEIGHING more than 5 000 pounds ap ece four gant valves tw ce as tall as a man were spec ally constructed for use on the America the largest passenger 1 ner ever built in the scountry Installed in the circulating condenser 1 nes of the vessel the

valves have an open ng th rty six inches in dameter Sol d wedge type bronze d sks welghing 1000 pounds apiece close the openings when the valves are shut Moto operated the valves are the largest ever ordered for the American merchant marine



## Here's My Story

DONALD WILLS DOUGLAS WAS BORN IN BROOKLYN N.Y., APRIL 6 1892



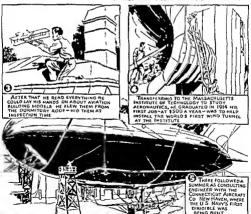
AT IT IN 1909 HE ENTERED THE U.S. NAVAL ACADEMY AT ANNAPOLIS

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ARMY'S FIRST BIPLANE IN ACCEPTANCE TESTS AT FORT MYER VA, YOUNG DOUGLAS PRIED OPEN HIS SAVINGS BANK TO GET MONEY TO GO AND SEE HIM

POPULAR SCIENCE



#### THE CAREER OF DONALD W. DOUGLAS





IN 1915 DOUGLAS WENT TO THE GLENN L MARTIN PLANT IN CALIFORNIA AS CHIEF ENGINEER AFTER THE COMPANY HAD MOVED TO CLEVELAND ONIO HE DESIGNED THE FIRST OF THE FAMOUS



BACKED BY A HOLLYWOOD SPORTSMAN, IN 1920 HE BUILT THE "CLOUDSTER -FIRST PLANE TO LIFT A USEFUL LOAD EQUAL TO ITS OWN DEAD WEIGHT THE FIRST DOUGLAS FACTORY WAS A ROOM BEHIND A BARBER SHOP



PLANE HE INVADED WASHINGTON, D.C., A LITTLE LATER AND LANDED A \$120 000 NAV CONTRACT FOR THREE OF THE CRAFT



IN 1924, U.S. ARMY FLYERS CARRIED THE FAME OF DOUGLAS MILITARY PLANES AROUND THE WORLD, MAKING THE FIRST CIRCUIT OF THE GLOBE IN DOUGLAS SHIPS WITH LIBERTY MOTORS



PASSEMENT DAY OF THE METERS OF THE STATE OF THE US AND 2 FOREIGN COUNTRIES DO NOT THE US AND 2 FOREIGN COUNTRIES DOUGLES AS WONTHE HIGHEST HONORS IN AWARDON, THE COLLIER TROPHY AND THE GUGGENHEIM GOLD MEDAL TODAY HIS CALIFORNIA FACTORIES LAPIOY 17,000 WORKERS

DECEMBER, 1940 127



A as t ased by fixed I ghts show v b at an of George Wash nation \$ days

#### Night Picture Catches Bridge Doing a Shimmy

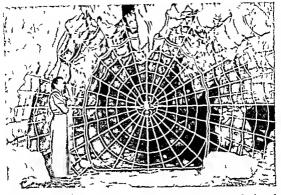
How a big suspension bridge shimmies under passing traffic bas been demonstrated photograph ically by Lilo Majer New York camerawoman Steadying the camera on a hand rail of the George Washington Bridge and pointing it toward the ap proaches she made the fifteen second time expo sure at the left Disregard ing luminous streaks made by beadlamps of moving automobiles she points out that all fixed lights show up as short, vertical arcs wh ch reveal the vibrat on of the bridge more graph ically than any engineer ing formula Anyone can duplicate the experiment with the simplest of cam eras by properly adjusting the exposure time

#### West Is East as Elephant Plows South Carolina Field

It might be a scene in a far away India but the picture below was taken near Cam den S C The elephants name is Alice and she's pulling a disk harrow on the plan tation of Matthew Ferguson sportsman, Though Beigbbors are said to be nervous about the poss bility of Alice going on a rampage she seems ou te peaceful



on Ame can makeut the elephant Alice :

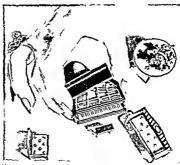


#### "Spider Web" Forms Gate to Subterranean Wonderland

PATTERNED after a spider web the silvery gate shown above admits visitors to Crys tal Cave in Sequoia National Park Cahl Its lacy design is in keeping with the delicate heauty of stalactic and stalagmite formations that sight seers will find within the cavern Hummated to best advantage these natural jewels sparkling in their rocky setting form an underground fairyland nexty opened to the public

#### Tiny Grand Piano Can Be Played with a Toothpick

Fore craftsmen took six months to build a twoinch square working mod el of a Steinway grand piano illustrated at right Played with a toothpick it has thirty six ivory keys and is strung like a full size instrument other objects in the photo -miniature enamel furni ture and a dancing girl's toe bell from Bombay In dia displayed on a finger -it forms part of a pri vate collection of 28500 curios from fifty four countries exhibited recently in San Francisco



M moture p and and furn ture Note Ind an dancers for bell on finger



the dag kicks himself up

#### Climbing Dog Can Tree Himself

Without a running start, a climbing dog owned by Aaron T Sack of Lowell Wis 18 able to shinny up trees to a beight of sixteen feet. The animal climbs straight up by placing its forepaws around the trunk of the tree and pushing up by means of its hind feet.

#### Want to Build Your Own Car?

AUTOMOTIVE engineers recently calculated how much it would cost to turn out a modern automobile by hand The same machine which costs less than \$700 when produced in quantity by mass production methods would cost about \$17.850 if made altogether by hand

#### "Home, James" by Tandem Bike

Wiffi gasoline imposs ble to obtain for use in private automobiles in Denmark wealthy Danes bire chauffeurs to take them to and from work on tandem b cycles Such cycle chauffeurs do the steering and most of the pedal ing Since July the number of b cycles in Copenhagen has jumped from 1750 000 to 38000 001.



A Dan sh bus ness man :

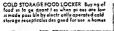
## Un-Natural History Gus Mager







#### COLD STORAGE FOOD LOCKER Buy mg of food in to ge quant t es when pi ces are low is made poss ble by electr cally aperated cald





GARBAGE DISPOSAL UNIT Any t tchen s nk con be equipped for the down the drain system of refuse disposal by metalling the electrically aperated unit illustrated above



FLASH LIGHT DARNING EGG Inserted in hos ery ar under fabr ca

FRUIT JAR CONDITIONER Irregular and chipped edges of glast fruit jurs a frequent cause of food spolage are easly ground to smoothness with this kitchen fool which works an oil standard

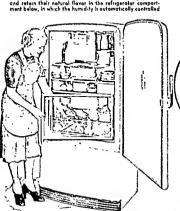


SHOE RACK Fastened to the door of a closet this convenent rock holds shoes in small space Factgear seasly hung up by means of spring clips which grp shoes as seen in photo

# for the Household



REFRIGERATOR HUMIDITY CHEST. Foods keep fresher and retain their natural flavor in the refrigerator compart-



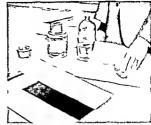
BATH KIT. For carrying toilet articles to and from the bothroom. this handy basket accommodates



COTTON DISPENSER, Absorbent cotton now comes in a thirty-foot ribbon rolled up inside a sonitary container. In use, the cotton is pulled out through a slot and torn off against a handy cutting blade

#### New Fnamel Resists Both Acid and Fire

DRAMATIC tests illustrate the durability of a new synthetic enamel for indoor or outdoor use Tables or chairs painted with it res st the action of muriat c acid in which zinc read ly dissolves When haphtha is ignited on a painted metal surface and al lowed to burn out soan and water easily wash off the smudge and there is no apparent change in the finish, Available in a variety of coors the fast drung enamel is declared easy for anyone to apply flow ng freely and leaving no brush marks One coat is usu ally sufficient



with the new ename) survive a real acid test

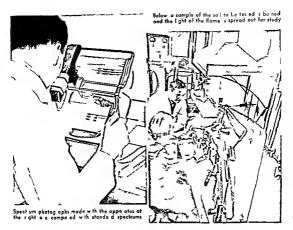
#### Giant Auger Bores Holes for Planting Trees in Parks

PLANTING trees has been made an easier task for the park department of Los An geles Calf by a curious machine that digs the holes for them in short order Just as a carpenter's auger bites through wood so a power operated spinning b t bores a ver tical hole into the soil to the desired depth Small stones and roots are no obstacle to

the whirling blade Lest it encounter a buried p pe hne however operators make a prel minary survey with a radio locator to make sure the ground is clear of any auch obstruction Carried over the area to be planted the device produces a buzzing sound in a pair of headphones when near any underground metallic object



After a rad a locator has made so a that there a e



#### Analysis with Spectroscope Shows Elements in Soil

In THE laboratories of the Macaulay In stitute for Soil Research in Aberdeen Scotland spectroscopes are now being used to analyze agricultural soils and determine the variety and amount of the elements present. A sample of the soil to be tested is burned in the flame of an acetylene forch, the light from which is spread out mto a spectrum for study Photographs of the spectrum made from the flame in which the spectrum made from the flame in which with standard spectrums that show known varieties and amounts of elements Thus it is a simple matter to determine what elements the test sample contains and what it lacks for growing various food products

#### Skylight Harnesses Sun To Help Heat the House

MAXIVUM sunlight for winder warmth was the goal of Henry L. Ross of Media Pa when he re modeled a barn for use as a dwell ing. The glass skylight set at an angle into the peaked roof is per pendicular to the suns rays at moon in m d winter so that a maximum of sunlight will enter rooms on the second story The glass is of a special type that admits ultraviolet rays and is laid in two panes which are separated by a dead air space for insulation



Tited to get the full benefit of the winter sun the sky I ght catches beat to help waim rooms on the second floor



Hay L Bate on whith unique stawbery as

#### Queer "Missing Link" Plant Part Rose, Part Strawberry

AFFER thity years of experimentation and cross breeding Major Harry L. Bate son hort culturat of Long Beach Calf has announced the re-creation of a curvos ms sng lnk of the vegetable k ngdom a potted plant which he believes represens a type which existed on earth millons of years ago. According to Bateson his product forms a link between the rose bush and the strawberry plant U sng it as a bas sfor development he hopes to produce an en freign engine for the start that the produce of the start that the start tha

#### Fruit Mold Kills Bacteria

A MYSTER OUS substance secreted by molds that form on fru t has been found to be valuable in destroying bacteria in researches by Dr Edwin C Wh te of Johns Hopk in Hosp tal Balt more Md

#### Try-Out Room Shows How Furniture Will Look at Home

TAKING at p from the stage a New York furn ture store has installed a try out chamber n which movable walls can be adjusted to reproduce the size and shape

of any room a customer is furn shing Spot Ights color the walls to match the actual apartment The customer thus sees how furnishings will appear when installed.



A anging ad a table walls in a fulliful edisplay com to dup cate the size and shape of an apartment in the cultome is hame. Gotoled spottight, as of the light go any fint deled

## **AUTOS**

How To Avoid Traffic Jitters • New Car Faces for 1941 • Tips That Will Help You Keep Your Car in Shape



### Do You Get



#### DONTS

- 1 Don't light troffic Instead of fretting and fuming save your nerves for more am portant things
- 2 Don't drive under physical strain. Make yourself as comfortable as you can with seat adjustments and cush ans.
- 28 Don't argue with other devers. Bawling out the other fellow does no good and merely frazzles your own nerves.
- 1 Dan't tolerate bugs in your car A smoothly running machine is good insurance against traffic litters
- Ton't drive a no sy car Knacks squeaks and rattles dull your senses and slow up your reactions in emergencies
- G Don't neglect to wea glasses if you need them Eye strain adds to general nervous strain when you are driving
- T Don't drive so fast that you lose the feel ing of complete control over your cur Confidence is what keeps your nerves calm

Scence tokes the driver for a ride. Hooked up to entruments that record his heatback blood pessure and nerve tension the motorst is being tested on the rood for reaction to stron

MAGINE that you are driving your car at a good cip down a boulevard running through the residential section of a city The road is wide and unclutered by traffic Your car purs along smoothly Suddenly with no warming whatever a woman darts directly into your path and throws berself directly into your path on the path of the path of What will your reactions be "What will

be the effect on your nerves? How will the shock of the experience affect your subsequent driving? California scientists can answer these

questions exactly For recently they have been nuring bodies—sturfed dummes of course but drivers don't realize that at the time—in front of automobiles as one phase of an elaborate series of road tests to determine how the bazards of automobile driving affect the nerves and consequently the draving ability, of the average motorist

# Traffic JITTERS?

#### By R. DeWITT MILLER

Their conclusions afford valuable hints on how all drivers can combat traffic j tters

The tests which utilize specially designed electrical apparatus were developed by Dr George Mount, a promi nent psychologist working in going out all a going going Oil Company of California In designing the instruments to check the nervous reac tions of drivers Dr Mount and his associates followed the principle that a person s nervous tension will be clear ly indicated in three main ways by his beartbeat by bis blood pressure and by the electrical sensitivity of his skin-for the electrical re sistance of your skin changes in direct proportion to the state of your nerves

By means of pick up micro phome attachyd to wrists and cheat instruments for record ing beartbeat and blood prea sure were easily adapted to the problem of making con tinuous records while a driver. "was actually operating a car under traftic conditions. The development of a method of recording changes in skin restance however required months of research before an acceptable solution, was found acceptable solution, was found

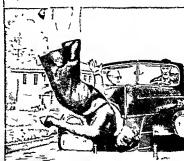
Electrodes are attached to the drivers hands Between the electrodes and the skin a special saline jelly is used to insure a good contact. From the electrodes wires lead to recording instruments rest lag on the rear seal of the car. By means of a pounter and dial the drivers skin existence of the property of the state of the stat

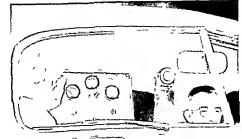


Bissfully unconse aus of what les ahead the guneapg driver spins metrly along on a boulevard nearly empty of traffic



when suddenly from behind a tree a bady hurtles through the ar sta the poth of the speeding car. Note the drivers expression below. Meanwhile the instruments keep on recording







Another method of checking up on noise \$ 10 pck up vibrations of the engine bulkhead as illustrated here



ins de view of a partoble instrument which writes a continuous record of the action of a subject's heart

Car no se was found to be an important factor in traffic litters. Above an instrument counts decibels at the diversis de

apparatus together with the heartheat and blood pressure instruments writes a running story of the nerve responses of the driver as he meets the numerous problems of traffic in congested areas

When hundreds of subjects had been tested on the road with this equipment the California scientists discovered that there are two distinct types of nervous strain brought on by traffic driving steady strain and shock strain

Steady strain is the general nervous ness that accumulates during difficult driving regardless of whether the motorast encounters any emergencies during the trip. In thirty minutes of traffic driving the nervousness of the average motorist, the psychologists determined is increased twelve percent by this steady strain.

Naturally steady strain will be fur ther increased by shock strain, the type that occurs when a driver just muses a laywalker cant stop for a suddenly changed traffic signal realizes that his brakes have faulted on is confronted with was found will increase a driver's nervousness by as much as twenty seven percent in a half hour of traffic driving

Twenty seven percent seems a tre mendous jump but the scientists point out that one close call in traffic will speed a driver's heart action as much as twenty-five beats a minute. At the same time, the resistance of the skin to electrical currents makes a similar change, blood pressure skyrockets, and muscles become tense Incidentially, it is interesting to note that women proved to be thirty percent more nervous than men after similar traffic-test drives In general Dr Mount states, women are less affected by steady strain and more by shock strain than men

ROM these traffic tests the scientists also discovered what they term a short-curcuit reaction. This occurs when a driver responds automatically to a traffic problem without any conscious thought about it Certain of these short circuit reactions can become dangerous. If a driver applies his brakes in any and every emergency be will

eventually form a short circuit reaction by which be will automatically brake without conscious thought of what he is doing Then one day an emergency will arise when applying the brakes would be the worst possible action to take—during a skid on a west payement for expansion on

To prevent this the scientists suggest that ail drivers look out for the first indications of any type of short-circuit nerve reaction and then combat it before it gains headway. This

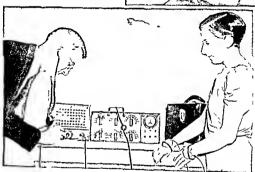
A microphone placed over the driver's heart picks up the heartbeat while electrodes on wrists help determine electrical resistance of the skin as demonstrated in the experiment below

can be done, they state, simply by occasionally forcing yourself to think why you stop or accelerate your car in a given situation, before you actually do it

Noise is another element that has a bearing on tradic nerves, the investigators found. By spotting sensitive interophones to record the sound volume inside of sevenal cars, and then having subjects drive the cars while their reactions were checked, the scientists discovered that car sounds deemed to a first drawing subjects.

But, strangely enough, the effect of car noise on a driver is to decrease the efficiency, not of his sense of hearing but of his senses of sight and smell, and his speed of nerve reaction This agrees with the psychological principle that when one sense is overstimulated, the other senses are dulled.





### NRW CAR PACES FOR 1941

HETHER it's body styling engi neering refinements ingenious accessories or any or all of these, there is something brand new in every car, every year That 1941 is no exception is apparent and the explanation is written on the faces of the new cars presented alphahetically on this and the following pages Outstanding body-design features on the new cars are concealed running boards wider radiator grilles and heavier humpers The fenders mostly have flatter tops while several have nearly perpendicular skirts dipping low and adding to the feeling of solidness On several cars, the more gracefully curved hoods are lower for increased visibility and wider where they fair into the windshields to conform to the generally increased width of the bodies and seats Tops are lower, while headlights are in most cases spaced farther apart. And bullt into these cars are factors of safety, comfort, economy, durability and driving ease to please the most critical tastes of America's motorists



BUICK Redesigned piston heads higher compres sion and two dual corburetors step up the power the new more massive and streamline Buicks



CHEVROLET wheelbose and body are longer; body is lower and more massive Concealed steps replace running boards; headlights blend sate fenders



CADILLAC boasts a 150 horsepawer motor in each of its 1 x times, and invades the medium price mor It has an optional economy rear oxle calia



CHRYSLER Fluid drive is available on both the s and eights with a high gear improvement front end design stresses horizontal lines



DE SOTO, at 105 horsepower also affers fluid drive as do Dadge and Chrysler Fender tops are flattened and made in one piece with hood sides



DODGE. Flowing curves sweep up from the base of the rad afor grille reaching all the way to the headlamps (Bumper attachments shown are extras)



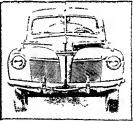
rad alor galles are recessed somewhat into the metal. The new bodies are both wider and longer



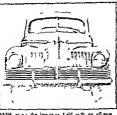
GRAHAM offers four I nes storting in the medium price field many available with superchargers The Hallywood shown has exceptionally law floor



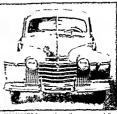
HUDSON Symphon c styling-meaning harmanious two tone colors inside and out-is stressed by Hudson, along with its brand new transmis



MERCURY, roomy powerful medium price line of Ford made cars offers numerous engine and chassis refinements, with lower, wider bodies



NASH on e s the low prec field with an ell new car slung on coll springs at all four wheels and toring chass and body welded as a single wall



OLDSMOBILE has s x 1 nes—three s xes and thee e ghts—with strong family resemblances. New bumpers protect the fant and reas fender skits



PACKARD affes sixes eights and super eights with at leng innovations in all lines. The familiar radiator outline still dislinguishes. 1



PLYMOUTH more powerful has a new grille de sign. A new second gear is used for most starting and a vacuum power gearshift is available if detired

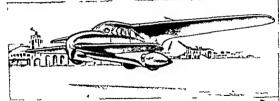


models a each a e are lable with either six or eight-cylinder engines. Appointments a e restyled

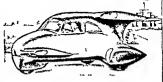


STUDESAKER in all models of is three (nes is room or more eyest king and responsive to the accelerator also affers a to pedo-type car

#### Detachable Wings Turn Three-Wheeled Car into a Plane



A HYBRID innd and air ma chine with wings that can be shed on landing is proposed for Oblo inventor and manufacturer The machine called by its designer an Aerobile is said to have pussed wind tunnel experiments although no actual flying tests have been attempted The body of the craft forms a three wheel to be pede shaped can for road driving proceed to the control of the craft forms at the control of the craft forms at three wheel of the proposition of the craft forms at three wheel of the control of the craft forms at three wheel of the control of the craft forms at the cr



The combination automobile a rplane an the raad in the upper picture it is taking aff as a plane with its detachable wings in place and a pusher prapellet

#### Headlight Chart Shows Safe Speeds for Night Driving

SAFETY charts for night driving have been worked out as the result of hundreds of tests by W W Harper nationally known traffic expert of the Pasadena Calif Police Department The charts grie the safe speeds under different driving conditions

Placed on the instrument panel of the car in front of the steering wheel the charcan be consulted at the beginning of a trip After a few days the safe speeds will be memorized and reference to the chart will not be necessary any longer



How fast should you drive of a ght? This chart placed on the dash as shown tells you at a glance

### PRACTICAL HINTS



1 As A SAFFY FACTOR for winter driving as well as a convenience an electric defroster fam mounted on the deck space behind the rear seat of a car and altimate at the rear window as an effective as one used on the wondchield It keeps fig and frost from the control of the season of the control of the season of the control of the season of

2 floor MAI PLOTECION consulting of a pair of five and dime store shoe soles of the store of the

2 A HANDY WEINCH for loosening or lighten mg the termusal buts found on most skept plugs can be made by simply drilling a hole signify smaller than the ottaked diameter of the nuts in the handle end of a surew driver. The bard wood wrench will loosen tight nuts without damage—W C W

4 TROUBLE LAMPS mounted under the hood and connected to a dashboard switch are a boon when you have engine trouble on country or unlighted roads at might I purchased two old cown lamps and nitings from the control of the lamb and lamb a

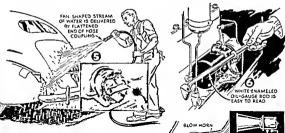


GLUED OF





### FOR CAR OWNERS

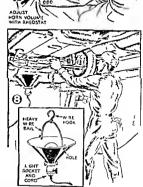


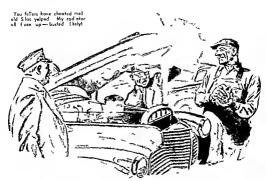
S A FAM SHAPED SPAY of water for washing cars is obtained without the necessity of holding a thumb over the end of a hose by means of an inexpensive device. This consists of a ten cent hose coupling with the inner sleeve squeezed flat in a vise. The coupling is then screwed on the end of the hose like a nozile when needed to deliver a strong rinsing stream of water to the work—E. M.

6 OUICMY SHOWNO THE OIL LEVIL a whiteenameled, eneaturing rod or dup state, much easier to read even if the oil is cloudy from long use. The rod should first be cleaned and then given too coats of high quality enamel. Brush the enamel only up to the full mark so that you can still tell when your crankcase is filled —E H

7 TOMING DOWN YOUR HORN for city driving is possible on many cars by placing a rheo stat in the your drewn and mounting W. on a convenient spot under the dash If the horn operates through a relay be sure and connect the rheostat into the relay circuit, not into that of the horn button —P M.

8 FEEDOM FROM GLAME while working beneath a car in a greasing prior under a carhost at night is obtained by replacing the unshielded wire guard of your brouble lamp with a metal cone as shown. With a little ingenuity you can rig up the onifit with a piece of sheet from a length of wire and a hook shaped as in the sketch for attach ing the device to the undersade of a car wherever it is needed—L B R.





## **GUS Gets Ready for Winter**

NOW sweepers swished on the road outside as Gus Wilson shed his ulster in the shop of the Model Garage on the first real winter morning of the cold weather season A heavy fall of the white stuff early the evening before had heen followed by the mercury taking a nose dive and now at eight o clock of a sunny w ndv morning the thermometer outside the office door registered only ten above zero

Gus s partner Joe Clark was gripning a good morning from the office door have a bad case of telephone ear by nine o clock Gus told him All the customers who as usual didn't remember to take the ar galandy ed I've beautic sw anaturant to get their frozen up busses started It's always that way the first real cold morning of the winter

Sure 18 Joe agreed It's hard on the ears and it makes you wonder why the Lord made so many people downright care o less but it s good for our husiness. Remem ber that morning when-

He was interrupted by the honking of a horn outside the shop doors. Then someone ahouted Hey you Gus Wilson-open up! It s colder n beck out here

That's Ez Zacharias Gus said as he I didn t expect unlocked the double doors hed be the first one to holler for help Usually bes a pretty wise bird when it comes to keeping out of avoidable car trou hle

Ez usually covers his R.F.D. route in a smart looking sedan but this fall he in vested in a light truck three or four years old but in A I condition for use when the dirt roads back in the country get bad or around the holidays when he has especially heavy parcel post deliveries to handle

He drove this truck into the thon benned from the seat, and scored a V on Guss waste box with an active service charge of tobacco juice By gum he said feller who sold me this darn truck took me fer a sucker and he d dn t make no mis He climbed out pushed his post man's cap away back on his shaggy head and shook a hig and hairy fist at the vehicle

First time I ever seed a automobile that d run ahead smooth as velvet, but wouldn't back up without goin' dead Took me a good teo minutes to get backed out of my ga-rage, by bookey! Every danged time I nut her into reverse she'd die down, start un again, hit a few times and then quit like a vailer dawr on met Take a look at her will vou Gus? '

Gus got into the truck. stenned on the starter, and shifted into reverse The truck ran smoothly over the shop floor, but the mo-

ment its rear wheels hit the snow-covered driveway outside, the engine sputtered, and then went dead. When he stepped on the starter again and shifted into low the truck ran back into the shop without a miss

"That's a new one on me ' he said time I ve ever known a car to act like that.

Gus checked the points and condenser and found them in excellent condition. When he restarted the engine it ran smoothly. He again backed the car out of the shop. As soon as its rear wheels were on the snowcovered driveway he noticed that there was a lot of vibration-so much that he could feel the engine moving back and forth on its rubber mountings. As soon as he shifted into low speed the vibration ceased and the truck ran smoothly back into the shop

When he raised the hood his eyes still wers so badly dazzled by the glare of the bright sun on the newly-fallen soow that he could scarcely see the engine. That was why he noticed the faint flicker of a spark where the wire entered the condenser When his sight returned to normal he saw that one of the strands of the wire had frayed soose, and that its ragged end was close to the condenser

He examined the trucks rear cod, and nodded when he saw that its spring suspension was like that used on some oldmodel passenger cars-a half conventional spring, with one of its ends connected to the frame and the other to the rear axle Without further checking he replaced the frayed wire with a new one 'All ready to roll" he told Ez as he lowered the hood

'Yeah?" the postmao "What the heck was the matter with her?"

"A strand of frayed wire was hitting against the condenser and shorting your engine, Gus told him

What? That don t make sense" Ez objectThe Boss of the Madel Garage Tells You How Ta Avaid Beina Chased aff the Road by That Old Man Zara Weather

#### RV MARTIN BUNN

denser and caused the short that killed your engine whenever you went into reverse in the snow Get it?" 'I guess I do.' Ez said doubtfully, and bit

roverge "

FILEDODELON

ed "The engine ran swell

except when she type in

me' Gus said 'The an-

swer is that, with this

particular type of spring

puling backward in the

enous cause a sort of

bouncing motion That mo-

tion makes the engine

rock on its mountings, and

that rocking brought the end of the fraved wire in-

to contact with the con-

That's what fooled

the

wheels

off a modest inch of coal-black plug 'Well, I better be gettin along an'-hey, there's some guy who s in a real hurry' It certainly sounded that way From out-

side came repeated squawks of a raucous horn 'Let him in, Harry,' Gus directed the grease monkey "If you don't bell knock our doors down '

Harry opened the doors. He had to step lively to get out of the way of a sedan which shot into the shop and came to a jarring stop Out of it leaped old Silas Barnstable, looking even more like a bantam rooster than usual in the ancient sealskin driving cap he was wearing 'Do something quick' the little retired farmer squealed "My motor's red hot and my radiator's biling over!"

Gus raised the bood and cautiously unscrewed the radiator cap, releasing a cloud of steam 'All right-you can switch off your engine," he told Barnstable it close, all right! I'll bet there isn't more than a cupful of water left in your cooling avstem "

"You fellers have cheated me' old Silas yelped 'That Joe Clark told me I ought to fill up my car with a lot of high-priced antifreeze, ao' I was fooi enough to do it



Now look what happens the first cold day we have My rad ator all froze up busted likely

No your radiator isn't frozen and it in t busted Gus reassured him But your hose is leaking so badly that your cooling system is darned near dry

I z Zacharias began to laugh—and when big Ez laughs the walls shake Tell the whole story Mr Barnstable he scoffed I was in here when Joe Clark argued you into buying that ant freeze and I heard him

warn you that your hose was so rotten that you'd probably lose most of it That's my

dea of cock eyed economy—wasting pretty near five dol lars worth of anti freeze to save a quar ter for a new hose

old Slas glared at Ez and turned to Gus Im depending on you to do the square thing about this he wheedled I aim thad any use out of that antifreeze so it would be only fair for you to replace it without

charging me anything But I aim t asking you to do that—make it half price for the new antifreeze and fill her up

Gus laughed No smoke Mr Barn stable he and good naturedly but very firmly Joe warned you that your hose was rotten You didnt inke his advice to put in new once so you il have to stand the loss I il hatall new hose and put in a fresh filling of antifreez if you want me to hut you'll find both items charged on your hight act or regular program.

You're the hardest man to do business with I we ever run up against in all my born days. Slas growled. No give and take spirit at all. All right—bave it your way. I'll he back for my car the sternoon.

Serves the old skinflint right Ez ob served after Silas had left He s so mean he-

He can't help being a penny pincher He was born that way Gu said. And after all the grief he gets into by being so tight as pretty much the same as the groef that a lot of other car owners hring down on themselves through plain carelessness. He a not the only man in this town who makes his winter driving hard instead of easy.

Ez settled himself comfortably on the end of Gus a workbench How come be wanted to know

The first thing you've got to have to

make winter driving easy Gus explained is a cooling system that is tight as a drium Antifreeze no matter what brand of it you use costs money and there's no sense in pourting It into your radiator and then all lowing it to lesk out. That's bone headed waste And besides that it is mightly lakely to result in serious damage to your engine the properties of the sense of

and that your pump shaft is tightly

packed
After you have
made sure that your
cooling eystem is
tight you should
make just as sure
that your radiator is
clean—that it isnt
clogged or helfclogged with rust
sludge scale or ead
ment You can do thet
by flushing; to di with

a ten cent can of the

#### GUS SAYS

The drivers who put off getting their cars ready for water are the ones who help me pay my in come tax so I really shouldn't ke ke to be t

hats odd for kepingaulte powder thats odd for kepingaulte powder charactery of the policy of the powder into the radiator and run your engine for another fattent minutes. Then drait her radiator and run your engine for another fattent minutes. Then drait her radiator and runs hour extensive powder into the radiator and runs hour extensive powder in the radiator and runs hour once with warm wester. Less than a half know that your radiator is clean.

Ive beard a lot of arguments about antifreeze mixtures Ez observed What's the best one Gus?

If your cooling system is tight and you use the proportion of ant freeze to water recommended by the manufacturer it will give your car absolute protection Only the water in the radiator will evaporate and if all your winter driving is short trips so Itile of the water will evaporate that it wont need to be added to until spring Its a good idea (Confining on page 237).

# HOME and WORKSHOP

Heating at Lower Cost • Wall Uni Modernize a Room • Arc Solderin



### Saving Money on

ARE YOU STOKING THE FURNACE WITH DOLLAR BILLS? HERE ARE SIMPLE WAYS TO SLASH YOUR FUEL COSTS

#### By IRA KUCHLER

Consu na A chitect

ID last years fuel bill upset your budget? Unnecessary heat losses in the heating system may have been responsible and a few minor repairs or changes will perhaps result in reducing the heating costs considerably

Start with a factor common to ell ateam and hot water systems-the paint on the rad stors. If the paint is cluminum or gold bronge the rad etor is losing upwards of five percent of its radiated heat by reflection back into the metal. Several coats of a good eggshell or flat finish linseed oil paint chosen to hermonize with the room and applied thin to a warm radiator will straight way knock a b t out of your fuel costs It isn't necessary to remove the old finish

If the radiator covers are badly designed closing in the heat beneath them they may waste as much as thirty percent of the heat Well designed covers permit a free circula tion of heated air

For efficient radiation all air valves on radiators must function properly. If the small bole in the cap is clogged up a pin will open it If the valve doesn't work even when clean yet there is good steam pres sure try turning it to a 45 deg angle or even upside down If this fails the valve should be removed and soaked in gasoline or boiling vinegar

Are your boiler and cellar piping suffi ciently insulated or are you burning up extra fuel and making a hothouse of the cellar? The extent to which insulation is needed depends upon the system and the immediate conditions. In a hot water sys tem it is well to cover at least the boiler and the pipes through which water is dis tributed to the radiators Covering the return p pes is also advisable so that the water returns with minimum heat loss. In vacuum and vapor heating systems it is better to leave the return pipes bare to

POPULAR SCIENCE



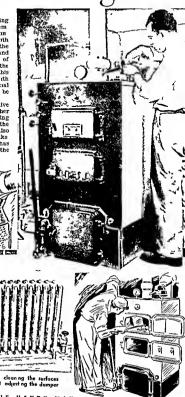
## Home Heating

aid in condensing any remaining steam that has escaped into them.

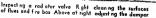
If the boiler is not already in

If the boiler is not already musulated it should be covered with two coats of ashestos cement the first coat being applied I\* thick and the second 1.2 thick If pieces of insuiation have broken away the bare spots should be filled with this comment. In two 1.4 costs or special air cell ashestos coverings may be wrapped around them.

Leaky pipe joints and defective pipes in all systems are another cause of heat loss Inspect the pipping of your hot air system and the smoke pipe to the chimney Also examine the boller for air leaks Note if the base of the boller has been properly cemented and if the



Jants in the hat ar heat ing ppes can be made tight and secure by pasting on asbestos paper



DECEMBER 1950

THE HANDY MAN



Below if insulation breaks away from the boler potch up the hale with as bestos cement. Otherwise some heat will be dissipated into the cellor



Above nsulate cellor ppng
with a reell jocketing mo
ter al Right drawing off
boler water to test far al
space between sections and

base has been well sealed with boiler putty Is there oil in the boiler

water of your hot water or stasm plant? Oil costs money because of the added fuel required for the heat to hresk down the greater surface tension produced You can find

out by drawing off a little of the bosler water in a small bottle from a cock under the gauge glass and shaking it up If bub bles in the water rise quickly to the top and disappear there is no oil in the water II however the bubbles remain suspended there is oil which must be removed. This may be accomplished either by having a plumber blow the boiler or by adding a plumber blow the boiler or by adding a propulation of the water which is the propulation of the water which is propulated to the oil and allows it to be drained out.

should be changed with discretion. Due to the fact that are is constantly being driven out in hot water holiers and in addition is being distilled in the case of steam botters stake water is generally better than tresh water It is less corrosive and bolds its beat better. Water therefore should be left in the bolder until the amount of sediment makes a change seem advisable.

The idea of banking the fire at night, even with coal fires has been routed as uneco nomical. It is cheaper experts have found to reduce the home temperature only a matter of 10 deg or so at night than to let the

temperature drop very low and then
have to supercharge the fire in the
moraing to bring tha heat up to nor
mal again In heating plants occ
trolled by clock thermostats main
haus a 70-dag temperature between,
say 7 in the moraing and 11 at night and a
markt temperature of about 60 deg

Radiators left turned on in rooms that are wide open to the cold are another source of fuel waste as they lower the heat in the entire system and force the furnace to in creased output

In the economical adjustment of the fire in gas and oil burners so much delicate and intracts mechanism is involved that the average home owner must rely for this up on the technical expert. Unless something seems serously wrong burners need he cleaned checked and adjusted only about once a year.

In the hand fired coal furnace however careful checking and attenton may pile up savings toat run up to forty percent of a careless bome owners bill. Begin your checking with the chimney as consistently poor combustion is due to an improper draft.

Often a chimney is too large or too small or its efficiency is cut by a chimney cap or by a neighboring gable or high building that blocks it. Perhaps its draft is weak ened by leaks in the hrickwork or by protructing the The inside may be inspected.

by holding a small mirror a the smoke ppe opening. If the draft is found to be too strong it may be cut down by partly closing to make pipe damper. At the same time you may economize by us ag smaller coal if the draft is too weak and the fault can not be corrected then for good combustion you must keep the coal bed th nner by fir ing more often and you must use larger coal to nermit air to set through it

coal to permit air to get unrough it For greatest comfort and economy the coal fire should burn as uniformly as possible. As a rule the fire box should he kept full and t s better to put on coal enough to last for half a day than to feed it in dribhies. Shake the grates no more than necessary to permit a flow of air through the fire. When the weather is midd the fire should sumber on bed of ashes from the should sumber or to be do ashes from the ashes for greater draft and severy the should sumber of the should sumber on the should sumber of the should sumber of the should should be should

bars to warp

Control of the rate of burn ng of your fur
pace fire should always be by means of the

draft damper at the bottom of the furnace and the check damper in the smoke pipe

In steam plants these dampers are controlled automat caily by means of a regulator which operates in response to the steam pressure and is adjusted by a st d gr weight Experience best teaches where to keep the weights for various weather cond to as Under the circumstances should the fire door be left const as a check on the deat!

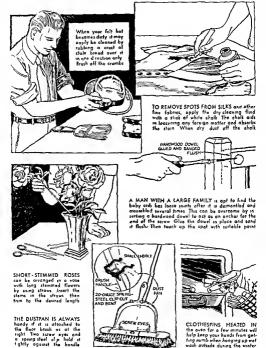
When firting at night in very cold weather hanke down the grate until 1 is covered white red her coals push some of the coals up in a plie in the back then fill the fire put w th coal leaving a red apot in the back glowing through This full pot and the deep fire will burn the least coal allowing plenty for the night and some for the night and some for the carty morn new the series when the series were new the serie

The red spot s the secret of additional saving It burns the surface gases that would otherwise go up the ch mney

Clean furnace flues constitute a final drastic source of fuel economy. Dust and soot on these flues insulate them from the fire as effectively as an asbestos coating. Cleaning the flues with a wire brush or scraper every month is none too much.



# Keeping the Home



POPULAR SCIENCE

## Shipshape



A 1/32" COPPER PLATE 9" in diam eter placed between gas flome and an all glass caffee brewer prevents the lot ter from cracking if the flome is too high



THIS ATTRACTIVE HANGING BASKET is made from an ald outo headlomp and some chain or light tope Remove the lens reflector and wining from the lamp and replace the sim Drill three holes around the time, equally spaced for fostening the chain or card



IF THE HOT WATER BAG LEAKS you con still use the bag by filling it with hot salt Heat the salt in a pan end pour it into the bag with the aid of a small funnel.



TO PREVENT THE END of a curtoin rod from catching in the material when pushed through the hem, caver the end with a strip of cellulose topo



REMOTE CONTROL FOR WINDOW You dan't have to crawl over the coal to close the coal bin windaw with this orrangement. Cut twa notches sn

the long extension orm so that notch A' holds the window apon and notch B keeps it tightly shut Fasten the two uprights to the floor juists above



# Eleaning

ENETIAN blinds should be taken apart in order to clean them properly Daily dust ing and wiping may remove surface dirt but after blinds have hung awhile nothing will make them look like new but a thorough renovation

To take a Venetian blind apart first tip up the bottom rail. If the lift cord (the cord that runs up through the blind) is first doubled back upon itself and jammed into a small hole pull the cord out with small phers. If the lift cord is con cealed under the ladder tape (the woven tape which supports the slats) which has been tacked across the bottom ral slightly raise one edge of the tape and pull out the lift cord and untie the knot at the end Do this to both cords then pull the cords up through the alats With the cords removed the slats can easily he taken out.

Dust the slata with a dry cloth Then lay each alat on a flat aurface longer than the slat (to avoid hreakage) and wipe with a cloth dipped in sospy water Go over the entire aurface first on one side then the other Wipe both sides with a clean cloth wrung out in cold water Finally rub with a dry cloth The work can be done faster if the slats are cleaned on old newspapers which can easily be discarded as they get dirty

In cleaning the state a fly spot or other blemish may be encoun tered that cannot be removed mere ly by going over it with a scapy cloth In that case place a pinch of granulated soap powder on the spot and rub energetically It will Bereindly Bive was

Furniture polish sometimes proves of value in removing blemishes and it will also make the slats glossier and easier to dust.

If you have light colored ladder tapes to clean an easy way is to use an ordinary quart Mason jar They must be dry cleaned because they are cotton and sbrink very easily

# Venetian Blinds

To remove the tapes first take the slats out of the blind as outlined before Then remove the small gimp tacks staples or screws that hold the tape to the bottom rail and the tilt rail. After the tapes are free, carefully measure their length with the tapes stretched tight. Roll the tapes up and place them in the glass jar. About two tapes can be accommodated at a time full plan with dry-cleaning full acrew on a cover shake the jar will be about the par with dry-cleaning full acrew cannot be accommodated at a time full plan with the par with dry-cleaning full acrew on a cover shake the jar well about the gain and remove the tapes. Measure the tapes for length and dry them while stretched to that length

If you wish to change the color scheme the tapes and cords can be dyed by a local cleaning and dyeing firm or with household dyes at home If new cords and tapes are purchased for dyeing, be sure to add enough to allow for shrinkage When the old tapes are used measure them first, then stretch them as much as possible before dry-cleaning them. As soon as the tape and cord have been dyed and rinsed properly, stretch the tape to the proper length and dry it while stretched

In case you have a large number of a type readily removed from the windows it will pay to fasten two 4" angle brackets on the basement wait or in the garage to facilitate taking the blinds apart. Place them so that

the longest blind will hang about 4" off the floor

In restringing the cleaned blinds, it is somewhat confusing to remember the path of the lift cords. This is indicated, however, for both narrow and wide blinds in one of the accompanying diagrams. You will undoubtedly find that all such problems solve themselves once you start work.





Above each slat is wiped with a clath dipped in scappy water, also three arrangements of lift cards and pulleys Left blind assembly

#### Metallic Insulating Paper Used for Making Light Reflectors

EXCELF'T light reflectors for various purposes may be made inexpensively from the type of insulating building paper that consists of paper faced on both sides with aluminum foil. One large store has been using it at a considerable saving in the

power bill because it reflects more light than ordinary reflectors. It is also possible to use this material or plain aluminum foil for making ahades over workbenches. It has even been used successfully in salvaging old auto reflectors—KENNETH GRAY



#### Pocket Tobacco Can Holds Painter's Line and Chalk

AS A REEL for his chalk line one sign painter finds an empty tohacco can serves the purpose better than s prece of board A slot cut into the top of the can holds the knotted end of the line. The can also acts as a container for the usual half spheres of chalk Masons who also use chalk lines will find this bunt equally helpful



#### How to Score Building Paper So It Can Be Torn Straight

A TOOTHED tracing wheel of the type used hy dressmakers boat builders and others is a good tool to score light roofing or build ing paper so that it may be torn

HIGH-GRADE furnace cement in putty form can be used to repair cracked fire bricks if the bricks are otherwise intact - L. J

#### Strap Keeps a Music Stand in One Compact Bundle

A FOIDING music stand is unhandy to carry without a case yet a case adds to the bulk and is just one more item to keep track of One musician solved this problem by soldering a piece of sheet metal as shown to the back of the upper end of the middle part of the desk This loop holds a short web strap in place When the stand is folded the strap is buckled around the parts and keeps them together with practically no increase in hulk -JOHN M AVERY



by a metal loop as shown in the crele

#### **Envelope-Sealing Moisteners** Made from Small Bottles

Two quickly made sealers for moistening ordinary envelopes are Illustrated One is made from a small bottle with a composition screw cap the other from a mucilage hottle for which a special stopper is whittled from a scrap of wood. The width and depth of the V slot in the wooden atopper are best found hy experiment. The hottles may be painted but not the bottom because it is used to smooth down the envelope flaps -W E. H.





#### Clamps far Uneven Surfaces

SITHIC wooden clothespins which are often used as small clamps, can be conaderably improved for certain types of work by discarding all but the springs and 
cutting new paws from ½ bardwood to the 
shape sbown above. These jaws are much 
better for gripping uneven surfaces because 
there is no twist or side thrust to throw the 
freshly glued work out of line as when ordinary clothespins are used—L. A. L.

#### Soft Rubber Thumb-Tack Cup



THUMB tacks are easily picked out of a cup made from half a rubber ball as shown It is attached to the drawing board in any convenient place by means of a single long-pointed thumb tack with the back with the short was a single long-pointed thumb tack with a single long-pointed thumb tack with the short w

#### Shellac and Wax Preserve Much-Used Boakbindings

To keep bookundings in good condition, a public library uses a simple method that is equally suitable in the home, particularly for books keep in the workshop or otherwise smilected to hard wear. Merely brush on a coat of white shellar, allow it to dry thoroughly, and then apply paste furniture or auto wax. Rub the wax to a high poiss. This finish resists constant handling and moissture and is easily cleaned.—E. B.



Furniture or auta wax is applied over a coat of white shelloc to protect the book covers from wear

#### Cleaning Separatar Bearings

WHEV a cream separator turns hard and stops with a droning chug at a time when you are too busy to give it immediate thorough attention, try this little trick Drain the gear case and flusb with kerosene Then refill with one part penetrating oil and two parts of the usual oil. This will often free the bearings of residue and restore the machine's efficiency—ROVGE M ROAFII

Falding Card Table with Only Twa Legs Open Pravides a Caasting Incline far Tays

If ONLY two of its legs are opened, a card table will provide a suitable incline upon which children may operate small toy autos and trucks as speedy coasters

BEFORE being repainted, rough textured or plasticpaint walls can be improved hy cutting down the high points of the old paint with a portable disk sander



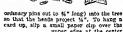
#### **CHRISTMAS** NEW IDEAS FOR YOUR



rations can be prepared during the next few weeks for creating a holiday atmosphere in your home this Christmas For example, when the Christmas cards begin to come in, do you like most people, toss them helter-skelter into a box? It s

much more fun to hang them on a decorative wooden Christmas tree like that illustrated above Cut the tree from %" plywood, make a trunk from a length of dowel rod, broom handle, or any available round stick, and cut a star-shaped base from 3/16" or 14" plywood The tree shown is 26" from base to tip and 181. " wide, the trunk is 1" in diameter and 4" long, and the base is a

six pointed star laid out in a circle 9" in diameter Paint the tree bright green or red to harmonize with other gay Christmas decorations Drive small brass escutcheon pins (or



upper edge at the center and let it project a little, then place the loop of the chp over the head of a Circles of brightly colored paper or paint will make the tree more attractive before the cards begin coming in and when it is only partly filled with the greetings

Christmas belis and wreaths hung behind windows or glass doors are sometimes wholly or par-tially obscured by the steaming or frosting of the glass This is especially likely to happen while the Christmas dinner is being cooked. To keep the glass clear, you can use to advantage the transparent



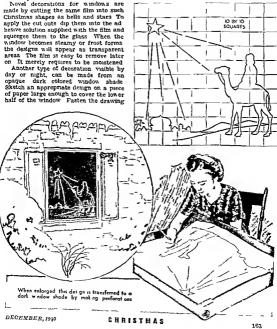
How a frosted window appears with a bell shaped flow and decoration

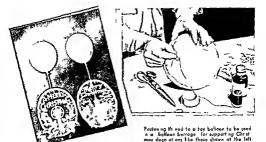
### DECORATIONS

films sold for cementing on automobile win dows These films are commonly sold in the form of kits consisting of several sheets of the transparent material a can of cement rubber squeegee and a piece of viscose snonge to mon up excess adhesive. When the film is applied to glass frost and water vapor will not condense on it except at very low temperatures

Novel decorations for windows are made by cutting the same film into such Christmas shapes as hells and stars To apply the cut outs dip them into the ad hesive solution supplied with the film and squeegee them to the glass When the window becomes steamy or frost forms the designs will appear as transparent areas The film 15 easy to remove later to the shade with adhesive tape and use a large needle to punch holes about 1,8" apart, outlining the design. Then remove the pa ner When the shade is hung over a window in the daytime the design will be seen from

\*A variety of Christmas designs to suit almost any roject from a hupe roof top s houette to a small lace card are gi en on a page of drawings follow ig this article





inside the room as a series of bright points of 1 ght. At night a floor lamp with either a translucent shade or none at all is placed behind the shade so that the design will be visible outdoors.

A holiday balloon barrage us an unusual way of supporting paper bella cut out de signs and other decorations that can be suspended from a ce ling or archway I flats some spherical top balloons and at a point on top opposite the stem attach a leingth of thread to each. To

do this coat a small ares with rubber cement let it dry for a few minutes then lay the thread across it. Out a small str p of elec tricians rubber tape or the sheet rubber material made for patching automolo le in in ret tubes and apply the tacky see to the cement covered spot across the thread Tie the thread around the strip Use the thread to suspend

the balloon from the ceiling or in an opening between rooms. The one end of a length of Christmas pack age cord to the balloon stem and the other end to the decoration if the thread is of such color that it blends with the background it will took as if the balloon alone is supporting the decoration.

Sticking Christmas seals

on woodwork painted walls and other surfaces is a sample way of brightening the home for the holidays. The seals can be arranged in interesting patterns. However if you mo sten the gummed adhesive on the seals to attach them you will have difficulty removing them later so use rubber cement. The seals then can be peeded off later on without trouble. Do not however attempt to cement them to wait paper they would be difficult to remove and the cement might leave marks.

Did you ever think of making special Christmas book ends for the holiday season. One possible ar rangement using cardboard cut outs is shown Ohistman of a charmey with his pack Faste this on a sheet of the figure leaving a chumque yith his pack Faste this on a sheet of the figure leaving a few inches of extra stock at the bottom Trutthe deges with

water color

Make the chimney in two acctions from the same cardhoard Cover the lower section with red paper ruled with black ink in imitation of brickwork and the up per section or cap with pa some other appropriate hue Glue the cut out figure to the back of the assembled chimney and then glue a piece of cardboard to the



Ch stmos seals form colorful spots f app ed to woodwork Use rubber cement so they can be removed later on without learing any was ghitly ma is

bottom so it will extend back under two or three books when the book end is in place Give the chimney cap a coat of clear brush ing lacquer and spread on tinsel or glutter Cartheard shapes for Christman decora

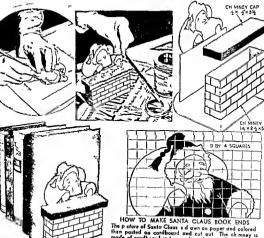
tons can be cut without tedons labor by using a sewing machine in which the needle bas been replaced by a small chisel like cut ter It is possible to purchase such cutting bits in some large well stocked hardware stores but it is easy enough to make one by grinding a broken needle to form a thin flat blade with a beveled cutting end Set the sewing machine for a boort stitch Such an arrangement will also cut very thin ply wood and other soft materials.

By using chemicals you can add color to Christinas candles and fireplace flames So dum compounds give the most brilbant effect—a golden yellow To color a candle flame simply place a small amount of baking soda at the base of the wick This will last for a long time. Washing soda or photographers sodium carbonate or sulphite can be usef as well

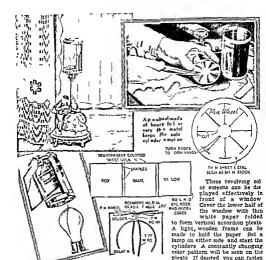
For a fireplace newspapers can be soaked in a solution of soda rolled tightly into sticks and put aside to dry or pieces of wood can be soaked in the solution and dried A few such pieces tossed on the fire will produce the color

Although sodium fiames are most brilliant other chemicals can be used to produce different colors as follows: Polassium compounds violet copper compounds other than the haldes emerald green calcium compounds yellowsh red strontium compounds scatel The yellow fiame of the fire will however often mask the weaker colors.

With two easily made color cylinders you can rig tup an attractive window display of ever changing colored light. Obtain some colored gleatin like that used over theating all spotlights and store window lighting units (Dont use celliulor or inflammable materials). Cut three rectangular piecess for each cylinder Fasten blue red any yellow pieces (or some other combination), degle to edge to torm a cylinder shate degle to edge to form a cylinder shate of the color shate of the color of the color



made of cardboard in two parts and covered with paper A cordboard base is provided and the parts shown sep arafed in the upper right hand sketch are glued together



The cylinder's proted on a pin point over a 40 or 60 worth loop flot or ses and couses it to revolve in diameter and 5 long. Use a stapling ma

chine or needle and thread Over the upper ends of the cylinders fas ten p in wheels made from metal foll such as that used around photo film packages and bind decorative strips of tin foll around the lower ends.

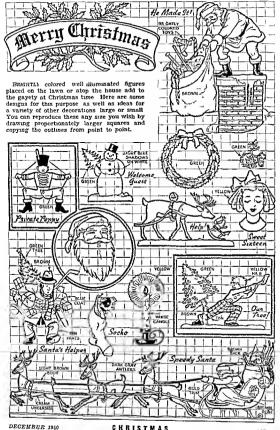
The pn wheels are merely dasks with rat dial cuts as shown Bend the segments to form blades against which be the currents raining about the lamp will strike Make a wire frame for each kamp which should be do ro 60 watts and at the top solder a short length of a pin point up. When the cyl inders are balanced very carefully no in these points are busined very carefully not make a myster or busined with tubes a minute or so for them to start to the control of the contro



a atsr wreath or other Christ mas design in the center of the

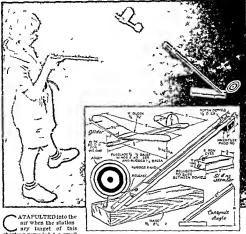
paper to act as a s lhouette

Newspapes itsocked in woshing soda solution and died produce brilliont colors in the freplace



### Toy Antiaircraft Gun

#### LAUNCHES GLIDER, THEN SHOOTS IT DOWN



shooting game is h t a small

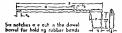
glider flies up to provide a moving target for the remaining shots on the six round rub ber band gun Novel as this game is it can be easily constructed from scrap materials and will furnish many bours of enjoyment for children

The catapult is built of two dowel rods set at an angle in a wood base A card board target wired as shown releases a sliding member that launches the glider The small stop block at the top of the

catapult is padded with rubber strips A dowel attached to a convenient handle forms the gun A slot at the front and sev eral notches near the handle hold the rub ber hand ammunition under tension

gun is operated by sliding the rubber bands out of the potches with the index finger A bttle practice will soon teach the secret of rapid operation. Aluminum foil is wrapped around one end of the rubber hands to give the bands sufficient firing power

Any small simple glider may be used or one may be built of balsa wood as shown The front end of the glider must be rounded so that it slides over the end of the catapult.





Paint the outside walls cream the roof red and the window boxes green with colored flowers. The main floor should be stained and varnished the terrace painted to resemble alternate gray and terra cotta tile and the lawn painted green. The interior walls should be done in pale shades of your own selection or they can be covered with plain wall paper.

Jorner Gox

Shape the two dor mes and flower boxes from sald wood The windows may be stemcled in blue instead of being sowed out



e ore lays of FRONT

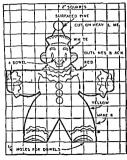
OOD grooming is easy to sell to a small child with this comb brush and handkerchief box. The hair brush (representing the hav) and an avory colored comb should be on hand before start ing as their sizes may require the dimensions to be altered The fence is cut from 14" ply wood Before glung the fence

The fence is panied and gived to the % plywood box cover leaving %" of the thick ness of the cover to fit inside of box Bevel the made edges of the cover to msure an easy fit The farmer is nig sawed from 14 plywood Give overlaye of

heavy drawing paper on the figure as shown in a small if lustration Trim them and make V cuts at the dividing lines when the glue has set to facili tete the painting Glue on the feet and make a mort se in the cover to receive them

Apply an undercoat to the For a novel finish, mix artists ol color with a very small amount of varnish and apply with a coarse brush. Use uniform vertical strokes on the box and farmer and swirl strokes for cover fence and hairbrush handle Only white off color is needed as any avail able énamel colors may be added to it for the tints Letter the child's name on the mail box Glue the farmer in place and apply felt on the bottom of the box.-THEODORE TORRISON

BACK ≰ND



#### TOY WOODEN

### CLOWNS

### CAN BE ARRANGED IN COUNTLESS WAYS

HILDREN will be delighted with these tolorful I tile clown acrohats because they can be put together so many ways Draw the des gn full size on paper then trace six of the clowns on 1 surfaced pine



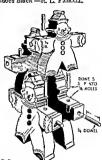
stock, and cut them out with a 1g sant Drill holes 'a' in d ameter or sightly larger and 1" deep into the hands shoul ders and feet of each clown as shown. Next cut several 2" peecs of 'a'' dowel These 1" lengths of dowel are the pins that hold the clowns together when they are hult up one on the other and they must slip in and out of the holes eas ly Paint the figures for added appeal Face and hands can be white the sut yellow trimmings red but tons and shoes hlack—R. L. FARMLI.

#### Delicate Soldering Jobs Done on Toys with an Ordinary Electric Pen



VERT small del cate soldering jobs are eas er if an electro pen is used as a solder ing iron

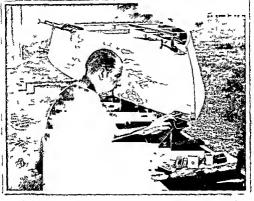
For example thepen may be employed for work such as solder ing a broken arm on a toy sold er where the heat from a large from might melt the ent re shoulder away and run the toy—R.B. W



DECEMBER 1910

TOYS AND DAMES

# Waterproof Plywood



Re a bonded ma nepywood the geast sage contibution es made to amoteu boat building

HE pr ne pal advantages of the new waterproof manne plywood in boat construct on are the saving in labor that results from fewer seams and the add tonal strength obtained in proport on to weight It is well adapted for use as planking on many types of small light weight botts and also for decking seats bulkheads floor boards and the like on all twee of boats.

Only res n bonded plywood made by the hot press process should be used Th s product s sold under various trade names and comes n th cknesses of from % to 1, and in sizes up to 4 by 16 Even larger panels may be had on special order but the price per foot usually increases with greater than ord nary lengths

If you are in any doubt as to the qual ty of the plywood to be used boil a sample of it in water for an hour or more. This will separate the ples of anything but resin bonded plywood Douglas fir is the wood most commonly used but the panels may also be obtained in mahogany and various kinds of hardwood

To prevent the edges of the plywood from tearing a very fine toothed saw should be used for cutting the panels and the edges should be finished with a sharp plane set rather fine Exposed edges should be sanded off round for about the depth of one ply

Do not countersuck for screw heads in for plywood except near the edges. Dr ve the screws t ght enough so that there is com pressed wood under the bevel of the screw head otherw se every screw hole will allow some modisture to enter the wood. Dipp on the acrews in marine glue before they are inserted is allo a good precaution

To prevent water logging and protect the indi adual piles from the stress resulting from the tendency to expand after absorption of water the edges of the plywood

### for Boat Building

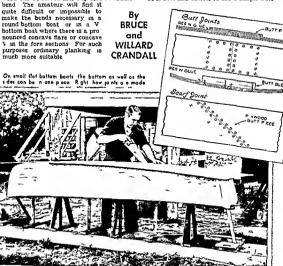
should all be sealed. This can be done with resin primer (clear resin sealer) or with aluminum paint of marine fills.

Bending of the plywood in one direction is easily done if the plywood is not too thick or the hend too great. If necessary it may be steamed or soaked in bouling water with out risk of having the plies come apart. Sharper bends may be made by mak ng a saw cut through one ply on the concave side at right angles to the arc of the bend. The saw cut should be filled with marine either before the vanel is fastened in position.

glue before the panel is fastened in position
It is only with great difficulty that ply
wood can be forced into any sort of double
bend The amateur will find it

Plywood is best adapted for planking only on comparatively short or lightweight boats as the panels are progressively more expensive per square foot in lengths over 8. For this reason it is often necessary or advasable in longer boats to use two or more panels to make the required length. This of course uncreases the number of seams and the joints cannot be staggered as in the case of an ordinary planked boat. No matter how carefully made these joints have a tendency to mar the appearance of the boat by interfering with the true curve of the sides and hottom.

It is best and easiest to use a simple butt



joint backed by a butt block of the same material. The planking should be screwfastened to the butt piece along the edges close to the seam. Also screw the butt piece along its edges to the planking. The new resm glue (synthetic reins addition) should preferably, be used at such a joint. Copper rives should be substituted for the screws if the plywood is very thin or other glue than resn glue is used.

If the spine comes at a point where there is a considerable curve in the side or bottom of the boat, it will be best to use a solid butt block 2, "thick or more in plare of the plawood butt piece so that the butt block may be cut to conform to the shape of the boat at that point.

A long scarf joint may be used in place of the simple square butt joint, if desired so as to distribute the break in the planking over a greater length of the boat, but in many cases it may cause so much waste of material that it would cost no more to use a single panel for the entire length

The grain in fir plywood has a consider about tendency to rise and the surfare to check especially when exposed to sun and weather. This may be minimized by the use of the resin primer as a priming coat for all exposed surfaces.

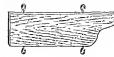
Expecial care should be taken with ptywood boast to prevent their rubbing continuously against any object, because ptywood though very strong is thin and aris a relatively soft wood. In case a hole is worn or punched in the boat, it is of course ont possible simply to replace one plank as in other boats. The entire side or bottom will have to be replaced or a patch made To patch a hole the broken or worn part should be cut away and a similar piece fitted in its place backed by a butt piere and fastened with screws and resin glue by the method described previously for making a splice

a spine. The following is a list of POPULAR SCIENCE MONTHLA Boat plans published before resimbended playerood was on the market, which are nevertheless particularly well suited, for one reason or another, to the use of players of the players of the players of the players of the plant difficulty of the bends involved and the requirements of weight and strength Players of many of course be used for many other parts than the planking in almost any boat.

Plan No	Post	Piymond Flanking Thickness			
133 137 133 R	Combination	or .			
147 R	Motorboat row boat	or 5," with all batters battens left out			
270 R	Folding duck	**			
271 R 257 R	Hill ty rowbeat High speed boat for small out beard motors	la or a			
261 262 R	Rating runabout	h." (About buit the battens may be sum nated			
251 R	Camper's utility	tena as shown			
204 210 K	Spert runabout				
314 R	Sal boat	to Ot in			
314 R 321 307 323 R	Racing sal boat Blackcut	Region or in aide keel abould be added)			
331 R	All purpose boat	S			
339 R	Midget boat or	7" or ""			
310 311 R	Sectional row	in or i. (Buttens			
314 313 R	Pisherman a outboard boat	is" (about haif the pattern may be eliminated)			

### Farm Roadside Sign Attached Between Fence Wires

FARMERS who wish occasionally to advertise produce for sale to passing motorists and fourists will find it convenient to use a signboard of the type illustrated. It is cut from an 8° board and a pair of screw hooks are inserted in the edge at either side by which it may be quickly hooked on to two of the fence wires or taken off, as demard—G E, HENDERICKSP.





# for the Home Workshop

WOODEN BASE

SHILL

se prounded to hold the lathe, and this oners out to form an unobstructed table ton 25" by 48" Such a table can be used in many wave in a shon where floor space is at a premium

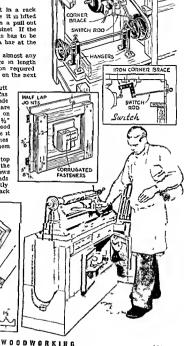
The turning chisels are kept in a rack that sheds off shavings. For use it is lifted from the drawer and holted on a pull out bar at the right end of the cabinet If the outhoard turning of large parts has to be done the rack is fastened on a bar at the left end

This cohoret can be fitted to almost any home workshop lathe a change in length being the only major alteration required The materials needed are listed on the next

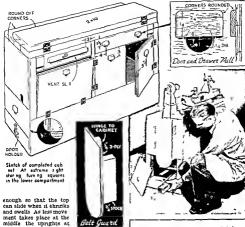
The top pieces may be butt glued with several corrugated fas teners driven into the underside However she tongue joints are easily made with a dado head on the saw Make grooves 14" by 14" in the edges cut a %" plywood strip across the grain and glue it in the slots While the top dries cut the frame parts and bolt them together

Plane the undersides of the top at the ends to seat them on the rails and attach with lag screws having washers under the heads Draw up the center screws tightly but leave the outer ones slack

OPEN



TO CLAMP RACK INSERT BOLT IN HOLES SLIDE DOEN END WASHE LINDER HEAD AND TIGHTEN WING NUT 2 × 3 STOCK



that point can be spiked through the top and lower rails Nail 14"

strips under the top at the edges and above the drawer eidee and pull bars Toenall the drawer and vent rails and nail in runners and side guides for the pull bars The floor boards are plywood supported

by cleats in the center where the opening facilitates sweeping out and inserting a screw driver for attaching the motor shelf The height of the latter is determined by the belt.

Hinge the lathe plank to the top with the hinge joint sunk halfway so that the plank will be flat Set the lathe on top and loop the belt over the pulley to locate the motor height Screw the shelf cleats to the uprights to suit or, if the shelf would be so high as to limit storage space unduly drop it and block up the motor

If a countershaft is used screw the shelf temporarily stand the countershaft as near the front as possible and locate the motor under the top according to its belt length If necessary, block it down A detail draw ing shows a simple method of operating the

### LIST OF MATERIALS

Part	No	Size		Length
Top	2	2"x6"	645	45**
	ī	2" 24"		
	ī	2 210"		
Corper posts	ā	2 x3"		27
Center	2			23"
Front and back Talls				47"
End rails	:			12"
Drawer and vent rail	ıì	2 x3"		45
		1 23		15
Pull out bars		2"x3"		15"
guiden c este	6	1 x4"		15"
Renhera	3	1 x*		15"
Shelf	2	1 x6"		48"
	1	1 x6"		28*
Doors	6	1"x""	•	13"
		1 x2		40"
Drawer front	1	1 ×3%*		24*
		net		
sides and back		2"x4"		54"
Sheathing 1	2	34 "X48"		27"
	2	", "x15"		27"
Bottom anelf and	-			
drawer bottom ;		2/ **15*		74"
Hinges -4 pr 11/2		45 1 pr	2 4	
Four friction calche	^-	a Basha		acrese f

lag screws 6-16 carriage bolls 4-46 long and 4-3 long and 4-3 long and 15 penny ap kes 16 corrugated rads 4 penny finish ns is d 4-3 long

now extra for length of toppleces seathing bottom shelf and drawer bot are fir three py wall board. All other is may be pite or fir.

switch with a pull rod through the vent An iron corner brace pivoted on a wooden support serves as a bell crank

Carry the motor cord out behind the

drawer rail and through a hole in the right and If it is too short for this method mount an outlet at the end for plugging in the cord Attach a heavy extension cord per manently to the outlet with a plug at the other end to connect to the circuit

The plywood sheathing in front must be cut so there will be a 1," projection of shelf edge and stiles (posts) for forming door stops Budd the door frame about 3/16" smaller than the openings and glue and brad the plywood in place fitting it with 1/16 clearance all around The end door nas two lugs glued to the back of the upper edge to catch behind the sheathing while the lower is beld with a friction catch.

Make the ventilator and nail it in place Bind the drawer with 3; side and 4; ver ited clearance. Put it in place and scribe a pencil line on the bottom at each side of the runner to align 1,2 guide strips. Fit the ends of the front and round the top edge as conform, to the observation.

Fit the pull out bars rather snugly covering the front ends with plywood blocks which should be glued and nailed and fitted



are mounted at an angle for easy removal

to the openings like drawer fronts. The open space beneath provides finger room. The drawing of the chisel rack is self-

explanatory Roller skate wheels make cheap and durable casters. They enable the cabinet to be jockeyed into place with little effort. A rubber tipped door bolder screwed to each end and snapped against the floor will prevent creeping when the lathe 31 m use.

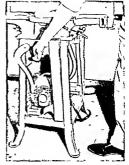
To support the weight of the inverted lathe clamp a piece of 1" pipe in the tool holder Plug the lower end with wood and

press on a crutch tip

A saw calmet is also illustrated It folds back unothrusely against the stand, but swings out instantly into the clear when open. The dimensions fit almost all standard saw accessories but alterations may be made to suit the huider The saws, being mounted at an angle are easy to remove. The double cleats which are botted to the saw stand (whether of the pressed steel or the cast vanerty with rubber liners to prevent drummting provide bangs space. A turn button on the east of the top clear, show the inings bolds the cabinet back against the clears when it as turned,

On steel stands, push striks can be handily bump bends the jointer The poster
pusher or mitten has a hole in the frost
end and a sloping one in the side sear the
back end The first slips over a bolt end put
in the shelf near the edge, the second
catches a holt passed through a hole drilled
in the top flagne and bent jouward at 45 der

The push stick for the saw bangs from another bolt through the run of the top



An upward and outward motion lifts the jointer push stick or mitten from the bolts on which it hangs

Robert Jaacks has begun the second year of his home workshop by arranging a down payment of \$12 on a set of chiesis and a wood turning lathe of 11" swing The monthly payments will be \$6 out of his budget of \$15 a month He also paid \$4 down on a used 1/3 hp repulsion starting motor, to be paid for in three months

### DRAW-BOLT JOINTS

### [ MOODMOKKING ]

This joint is simple, quickly made, and capable of being tiphtened from time to take up slack due to shrinkage It is used manify in 2° or thicker stock, for bench construction or other heavy framing 1. Square stock for the joint cap center in on width of rail and stile near joint end 2. Gauge center inest for thickness and width, one end of rail Gauge across stile center center in the contract of the contract o



be used each sude of the bolt if desired to prevent any possible twisting of the joint.) S Put 1, carriage bolt through stile and far enough into rail end to start nut on with washer underneath. Turn up nut until slack is taken up

head flush (A dowel may

POPULAR SCHINCE MONTHLY SHOP DATA FILE





Decalcoman a des gns are used for dec a ating the sheet cork facing. The un covered part of the sheet ron back ng s pointed with a bright ename! The rack is shown in use of the left

# Decorated Cork Covers Face of Breakfast-Newspaper Holder

READING the morning newspaper while eating your breakfast becomes a greater pleasure when the paper is propped against

this novel rack which was de signed by a member of the Metro politan Junior Achlevement New York A strip of sheet iron 8 wide by 24 long is the supporting material On this a sheet of 1/16 sheet cork is glued. After the glue has dried the cork faced strip is bent as shown the highest neak

being about 7" tall Paint the uncovered iron with bright enamel and apply decalcomania (transfer) designs to the cork

Wanted Three Hour Craltwork Projects

Have you built any arg not croftwo k novelt as that take only an evening to inish? If so send us bref well llustrated articles describing them Cosh s pad upon acceptance for all avoilable materal

### SOLUTIONS

### I METAL ETCHING-11

Etching solutions should always be mixed in glass containers. Glass photo graphic trays are excellent for flat work. Heavy square fish howls are best for large work. Earthenware is not satisfactory as the material unless very heavily glazed will absorb the solution.

Nitric acid is used in etching most metals. In many cases one part commercial mitric acid is added (CAUTION Do this very slowly and carefully) to one part of water. Full strength acid may however be used with satisfac. tory results and much greater speed. Where the process of etching is carried out with a slow etching solution it is well to sur occasionally or rock the tray from time to time to remove any bubbles and the scale that forms and inter feres with even biting

Store all etching solutions and clear acids in glass stoppered bottles relieve burns received from acids apply sweet milk. Ohve oil is next best. If

nothing else is available apply plenty of water

If in etching copper or brass at is desired to leave the undercuts dark to set off the work in a polished piece coat the etched parts with a solution of liver of sulphur (potassium sulphide) Wash this off before removing the asphaltum. To make the solution dissolve a piece of liver of sulphur the size of a thimble in about a punt of water

POPULAR SC ENCE MONTHLY SHOP DATA FILE

# Decorative Leather Initials

# CUT OUT IN QUANTITIES ON A SCROLL SAW



deleather craftwork you will find the making of leather initials and mono grams is a practical hobby Under fa vorable circumstances it might also be developed into a profitable one identifying initials are desirable on go many dif

ferent articles in add tion to those made of leather that the last is endless. Thin metal mittals however bend out of shape readily or become dented those of thin plastic break easily and transfer initials wear or all too quickly Leather initials do not have any of these objections and you can apply them e ther plain or hand touled to any two of surface.

with cellulose household cement

Scraps and small pleces left over from leather work projects are entirely su table Wh te the cutting may be done by hand the secret of rapid production is to use a scroli and the secret of rapid production is to use a scroli away a print transfer if one is squared using a print transfer if one is squared to the squares find blocks up to 1 the K fastening them together with rubber crement. To the top terment a tracing of the initials or monograms Suitable letters can often be of piped from magazines and can be of piped from magazines and the books without taking the trouble to make a from the total the second of the track of the books without taking the trouble to make a from the total can be a second of the second of the

If a power acroll saw is used the blade should be a very fine one. The writer uses thin narrow blades intended for cutting

La ge nt als may be hard tooled to match any leather article to which they are to be applied

tig san nuzzles. When the cutting has been done congrate the individual initials and rub off the rubber cement from both sides.

For most purposes the initials are used niain but they can be dampened and hand tooled with border lines or embossed de signs if it is desired to match the leather article to which they are to be attached. Special leather modeling tools are not re quired because a nail set numb or aul can be ground or rubbed on an oilstone to a smooth himt noint that will rive the kind of line required

Aside from tooling the initials, they can be given a number of attractive finishes by other means. A bronze appearance is oh

tained by painting the leather with a solu tion of one part methyl violet in eight parts of water the measurement being made ha weight. To give the effect of white veining rub in a little paste white lead-that is white lead ground in oil-and then remove the excess and allow it to dry

For a patent leather finish mix 1 oz of asphalt varnish with 5 oz raw linseed oil and add 2 oz of copal varnish Up to 5 oz. of turnenting may be mixed in to thin the material to a flowing consistency

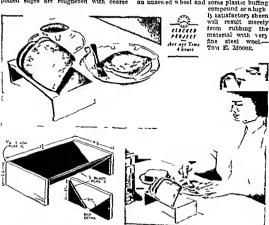
With or without a special finish the ini tials are attractive on hand have gloves cameras and camera cases luggage and many other articles - KENNETH MIRRAY

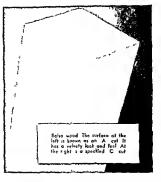
# Toast and Bread Tray of Brilliant Plastics

SPARKIING color contrasts and case of Working make modern plastic materials extremely desirable for home workshop use as in the case of this small toast and bread trav It is built up of 1, black and 3/16 Sellow plastic

The sides are 3 by 73. Carefully miter the long lower edge of each by planing the material against mitered gu de blocks. The planed edges are roughened with coarse sandpaper and joined in a clamping figwith the special transparent cement soid for fastening the plastic material. The ends of the tras are made of three pieces eachone vellow end rectangle to which is cemented two black 45-deg triangles. All excess cement must be scraped lightly from the sounts before it has set

The completed tray may be buffed with an unsewed wheel and some plastic buffing





# What Model Makers Should Know About BALSA W 0 0 D

# By FRANK ZAIC

Above method of testing bolto wood and basswood Both woods have approx motely the same weight but hosswood bends twice as much Atright all balsa model using C cut for oil parts except the propio

N ECUADOR there are trees that musbroom up to height of from forty to sayly feet in a compara trely short time. It is not unusual for them to attain dameters of from 12° to 18° within they years. If you were to follow one of these trees through the many processes that he between the living tree and usable wood you would eventually find it on the workbench of a model airplane builder. This in a nutshell is the life atory of the world a lightest wood balsa.

The weight of balsa has been standardized at 8 lb per cubic foot, but it varies in practice from 4 to as high as 20 lb. The rate of growth and the resulting weight depend on the local conditions. The growth is preatest in open spaces near water and where the



soil is moist. The lightness and softness of balsa is due to its large, thin-walled rells It is easily compressed with a finger nail, and nails or screws cannot obtain a secure hold. It takes glues or cements exceptionally well because its large, open cells allow the adhesives to flow into them and thus insure good anchorage

Although balsa is used for many com mercial purposes, such as floats and insulation boards the bulk of the output is employed for model airplanes. It is estimated that American boys use about 3,500 000 board feet of balsa every year (A board

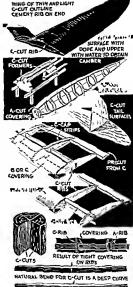
foot is 1" by 12" by 12" )

The advantage of balsa over hardwood for model airplanes lies in the ease with which it can be shaped with a sharp knife or a razor and also the fact that it can be used in comparatively large sizes. It is well known that deep spars produce rigid construction For example a 1' by 2" spar when equally loaded while it is laid flat and on edge, will bend twice as much in the flat position Also, if the size is increased to 1" by 4" and a similar load placed on its edge, it will bend only one quarter as much as the 1" by 2 did while also on edge

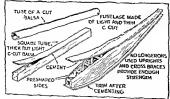
Since balsa is so much lighter than hardwood we can use large spars to produce rigid construction with lightness-a most desirable condition for model planes, which have to maintain their serodynamical

settings for flying and stability

You can easily test the comparative bending qualities of balsa and hardwood Cut a 14" by 12" by 12' strip from 8-lb balsa, and a 14" by 14' by 12" strip from basswood Both pieces will weigh approximately the same since basswood weighs about 30 lb per cubic foot. Cement the end a board and suspend equal weights from the free ends You will find the basswood hends about twice as much as balsa, just because it has less cross sectional area for similar weight. It is of course, understood that both atrips would very likely break at similar maximum loads, since the strength



NATURAL BEND FOR A-CUT IS OFF CENTER



C-CUT

Above how the three cuts are ob tained from a balso log At tap and at left methods of using balsa in model airplane construction

of a material is more or less determined by its specific gravity Balsa can be used highly loaded without having it bend ex cessively or we can say that balsa is much more brittle than ordinary hardwood

The natural grain characteristics of balsa are similar to those of hardwood Balsa sheets cut along the three lines shown in the drawing of a portion of a log have the same characteristics as those cut from hard wood A speet cut along the line marked A has a velvety look and feel It will be found to bend very easily into tubular form

A piece cut like B has tiny speckles and feels stiffer when an attempt is made to bend it into tubes C has large speckles and a glazed surface and it is especially brittle aga nst tubular hending. These special character stics can be used advanta geously for model work

The so called C cut is perfect for com pression members such as ribs and bulk heads also for all halsa models. It can be loaded three times as much as an A cut of similar size before it will bend or buckle But when it does buckle it will do so with out a warning and will snap cleanly into two C ribs will keep shape under cover ing pressure that would normally double up the A type

Bulkheads can be made from single C sheets matead of double ply Use the C. cut whenever possible to obtain maximum strength with minimum of weight. The C

radius depending on its weight and thick ness Light thin and moist C sheets can be made into tubes but only after you have had some experience One of the main rules is to keep the wood under constant tension

as you roll it around the bending rod. The A cut is a natural bender and can be bent considerably without moistening When moist it will bend into surprisingly small diameters. Use it for tubes and for covering sharp curves

B cuts have the in between characters tics of A and C They should be used when bending requirements exceed the C specifications but are not so severe as those which only A can handle

So far we have covered the grain uses pertaining to sheet stock Although C cut is best for deep spars because it will resist twisting forces it was found that such spars will have a natural tendency to curve so that it is difficult to make surfaces flat Since it is more important to have a perfect aerodynamical line up than a slightly stronger construction we have to be satis fied with spars cut from A stock The natural bend on A spars is in a direction easily counteracted during construction. Use C stock by all means when the out line such as trailing edge is of curved variety and cut from sheet Just consider m each case which you would rather have -a good anti twisting but possibly bent spar or the straight A type

(TO BE CONCLUDED)



Above an example of multiple stringer construction. Note the smooth lines of the plane. At the left the Good brothe ; with the r balsa model controlled by rad a which has been a consist ent winner of model a rplane meets during the post three years

200

# Track

Rolls should be cleaned fe quently by wp ng them with a rag me stened with carbon fet rachter de a similar cleaner

# Maintenance

# ON YOUR MODEL RAILWAY

KEEFI'NG track in good condition is wery but as important on a tin plate model rallway layout as on a real system Eventually neglect results in short circuits and in the general slowing down of the trains and unsatisfactory operation of the system.

Before assembling a layout, pinch the openings in the rails in which the pins of adjoining sections at. Use a pair of long nose pilers placed between the opening and the bottom of the rail as illustrated. In add tion, rub down the tops of the rails and pins with a very fine grade of site and pins with a very fine grade of sets wool. Make sure the track connectory hold the sections lightly together

Check the insulation of the middle rails by connecting two wires to a dry cell, or to the transformer Hold one end on the outside vall and touch the other to the

# By C. ELMER BLACK

middle rail. If a spark results replace the insulation material under this rail at the three points where the rail is ci pped to the ties

The most efficient way to introduce current into the system is to solder wires to the tunderside of the rats. This prevents loss of voltage due to poor connections and on any but the smallest layout this should be done about every five sections. Use red-covered insulated wires on the notice rails and black-covered in suitated wires on the outside rails. The colors make identification easy.

On curves place short lengths of match sticks under the outer edges of the ties to give sufficient elevation to allow the train speed to be increased with

For an extremely smooth riding surface the ends of the ralis may be staggered to the wheels do not bump over the joints in the track at one time. This takes time but is worth the trouble. Do not disturb the middle ralls which are insulated but loosen the clips holding the outside rails to test sea also side one rail forward and the other back '4" either way from the end of the middle rall. Then registen the clips At points where switches or crossings foun, saw off the ends of the track sections equare as it is not practicable to alter the switches or crossings.

out the danger of derailments

After the system is in operation clean the rails frequently with a rag moistened with carbon tetrachloride or other safe deaming Tolds.







Using a gauge with A" steps to stagger the rails so the wheels do not bump over all the sonts at once. Center solde ng feed wires to the un

de side of the rolls. Above pinching openings in the rolls. This creates tighter joints when pins of adoining sections are pushed into place

# FIVE STUNTS WITH



# Simple Meter Is Made af Coil and Campass

WIND a dozen turns of insu lated wire around a cardboard ring insert a small compass and you have a handy meter for volts or amperes A pencil sharpened at both ends and in serted in series with the cir curt as shown at bottom of opposite page will form a re sistance of graphite to raise the voltage range. To increase the range for amperes instead a parallel connection or shunt by passee the meter At left it is demonstrating the surpris me fact that the size of a wet or dry cell has nothing to do with its voltage as shown by the compass needle s deflec

tion However bigcelle
give higher amper
age and last longer

# Tiny Homemade Cell Shows How Electric Motors Work

Make a loop of copper were about two unches in d smeler Plass the ends through a large saft cork and solder them to small aguares of zune and copper respectively. When the tiny electric cell is shoated in a tumblersti of diute subphure and current slows through the loop and sets up a weak magnetic field Bring an electromagnet bear and the coll will align these than dehp over at Reverse the battery councettons of the

electromagnet and the loop backs off turns around to present its opposite face and slips on again Electric motors apply the same principle



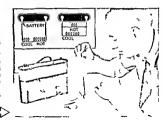
# It's Easy Ta Magnetize Small Pieces of Steel

SCEW IRIVES SCISSOTS and compass meedles are easy to magnetic permanently Wrap fifty turns of bell wire around a card board tube of about half then diameter Connect this unprovised solenoid or core less magnet to several dry cells To magnetize an object simply insert it in the tube for a few seconds while the current is one of the seconds while the current is one as the second with the seconds while the current is one as the second with the s

# ELECTRIC CURRENTS

### Changing Circuit Gives Different Heat Effect

To SEVENIA dry cells connect in series two coils of fine insulated wire one of fifty turns and the other of 100 turns. Place a chemical type thermometer within each coil and read its temperature after current has been flowing exactly one minute. The 100 turn coil becomes the hotter Re arrange the coils in parallel repeat the tests and you will find that with this circuit the 100 turn coil is the cooler one

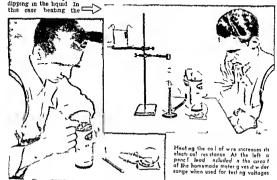


# How Temperature Affects Resistance of a Conductor

CONNECT your homemade electric meter in series with a small coil of hare wire and a dry cell. Heat the hare wire coil and the current will decrease as shown by the lessening deflection of the compass needle The resistance of the wire has been in creased by beating so that less current is allowed through. Now substitute a beater of cold salt water for the coil and connect the wirest to metal bales.

current on your meter owing to lessened resistance of the conducting solution. This illustrates a general rule of electricity—that heating a solid conductor usually in creases its resistance while heating a liquid conductor or electrolyte usually diminishes its resistance. No pendir exist ance is needed as this is an amperage test.

salt water will indicate a greater flow of



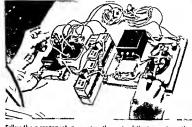
"Audio" Telegraph



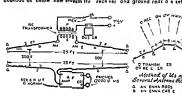




I mounted the parts on a 7" by 8 baseboard It can of course be placed in a cabinet or it and the receiver can be housed together in compact portable carrying case When buying the bell trans former which is the only crit cal part in the transm tter circuit make sure that it pro t des a 110 volt pri mary and a 12 volt sec ondary In the actual hook up the windings are used n reversethe 12 volt wlnding serving as the primary and the 110 volt wind ing as the secondary Connections to the cop per anteana rods and to the 71/2 volt battery can be made through Fahnestock clips screwed to the base board (See next page )



Follow this a rangement in mounting the ports of the two units on their basebaa ds. Below how transmitte inconver and ground rods o easet up



# FRANK TOBIN





ts botte as and the necessary week

For the audio amplifier receiver & dual purpose 1DSGT tube is used. The diode portion of the tube provides the first or in put stage the pentode the second or output stage Notice that an aud o transformer as used in the first stage and resistance cou pling is used in the second

A small 112 volt flash 1 gbt cell or an ordinary dry cell and one 45 volt B bat tery prov de the current necessary to power the receiver circuit These batteries are in dicated on the wiring diagram together with the socket connections

In setting up the receiver and transmitter be sure to follow the directions given in the drawing The antenna rods must be placed approximately 25 apart and in a line parallel to the line of the rods connected to the receiver If a greater d stance of transmis sion is desired use add tional antenna rods in the transmitter circuit and place them in open curves facing toward the receiver

### PARTS FOR "AUDIO" TELEGRAPH

Amateur transmitting key Be I transformer (see text)

House buzzer Aud o transformer 3-to-1 ratio

Baseboard octal socket, Tube (1DSGT)

Fahnestock clips (e ght)
Headphones 2 000 ohm
Antenna rods (four see text)
Mica conderser 005 mfd

Tubular paper condenser 902 mfd 600 Carbon resistor 1/2 watt 1 meg Carbon resistor 1/2 watt 50,000 ohm

Miscellaneous Flash light batteries batteries wire baseboards etc

# Get Started Radio

LTHOUGH designed primarily as a phonograph amplifier for use with either a crystal or a magnetic pick up this fourth circuit in the Get Started in Radio aeries which began in the September 1940 issue is so versatile that it can be used for other purposes as well. Connected to a simple crystal receiver through a 3 to 1 ratio trans former for instance it can be used to provide loudspeaker volume on near by broadcasting stations Used with a mi crophone it can be made to serve as a small public address system.

The parts for the amplifier were all in cluded in the main list of parts given in the first article If you bought the list complete you have nothing more to buy for even the baseboard can be used again by turning it bottom side up to conceal the boles that were made in mounting



ea phone can be used as a public address mile

# PART IV... A THREE-TUBE AMPLIFIER

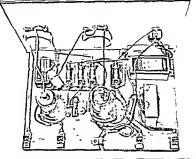
the parts for the first three circuits

Your first job will be to take apart the fourtube receiver constructed last month, Be careful in removing the parts, as many of them will be used again.

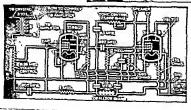
Hoth tubes (25R8GT and 70L7GT) are used in the amplifier circuit. The 25R5GT, not using its triode section, serves as the input stage and the 70L7GT provides the output. As shown in the diagram, resistance coupling is used and offers sufficient volume for ordinary use.

In placing the parts, follow the photographs. Mount the 25,000-chm tone control, the 250.000-chm volume control, and the on-off switch on the front panel The volume control fits conveniently in the space vacated by the variable tuning condenser used in the previous receiver circuits.

When used as a phonograph amplifier, the unit should be connected to a high-impedance pick-up with a rating of approximately 18,000 ohms.







Soldering iron and plaers are the only tools needed to assemble the inexpensive amplifier

How the parts are wired. Below are the two socket wiring diagrams



# NEW DEVICES FOR

# Dial Light for Portable Radio

CONTROLS of hattery powered portable receivers usually not illuminated can be bathed in light when needed if a small fountain pen flash light is fastened to an easily made chip screwed miside the cover





# New Snap-Button Binding Posts

DRESSMAKERS snap buttons replace con ventional plug terminals on a new light weight 67½ volt B battery designed to fit they portable radios Plus and minus buttons are reversed to prevent mistakes

# Tilt-Front Radio-Phonograph Leaves Top Panel Free

HINGED at the bottom the entire speaker grille on the front of a new console model radio phonograph awings out drawing the turntable and pick up arm assembly for ward to a position where records can be easily changed Besides making the phono graph access ble the design dispenses with the large bisged top frequently found on

console type instruments and per mits the top to be used for vases books and other decorative or use ful objects. Tuning controls set in a panel above the grille are reveal ed when a small double hinged lid is raised and folded back.





# RADIO ENTHUSIASTS

# Tiny Transformer Matches Microphone to Amplifier

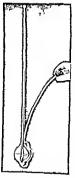
SCARCIN two inches long a new microphone cable transformer for public address systems at taches directly to the input of the amplifier when it is necessary to couple a low impedance mike with an amplifier having only a high impedance input Two types are available one baving a 30 50 chm primary and the other a 200 500 chm primary Each unt it said to be completely shielded against hum pick up The compact unit uses a high permeability magnetic alloy core





# Knob on Dash Cantrals New Car Antenna

CONTROLLED entirely from inside a car the new telescoping car radio antenna shown at the right is easy to in stall and operate Avail able in several models for installation either on the metal strip divid ing some windshields or on a windshield pil lar or the s de of the cowi the antenna 19 controlled by means of a knob attached to the dashboard Turning the knob raises or lowers the antenna to the ex act height desired for peak reception.





# Carrying Strap Is Antenna far New Midget Portable

WEIGHING only four pounds a recently introduced portable radio exsembling a miniature cameras of a ried by means of a, shoulder strop containing a specially designed or antenna The plastic calmet houses four tube superheterodyme receiver powered by a single long if hattery A permanent magnet speaker provides good volume and towards pro-

# LATEST AIDS FOR



# Midget-Type Flash Bulb Comes in Handy Carton

PROUNTOR a br II ant stab of I ght, a new m dget we fulled photofash build a now available to camera fans a colly two inches b ght first limited and the first limited and the first limited and the compact ten build packages who can be carried in a packages who can be compared with a baycnet base In the photo graph above one of the midgets is compared with a 1937 model build of the same build ance. The new builde are ac ent fically shaped to throw an even pattern of 1 gbt.

# New Double-Purpose Reflector

HATURE a removable inner shell a novel piblic flash reflector enables the user to choose between two types of allumination when he is making pie tures after dark or under poor lighting conditions. The reflector has a conventional outer shell of highly polished chrom um When it is used alone a de beam a given off by the reflector. The finner shell with a cruzish pied a rough beautiful.





# Master Foot Switch

THESE outlets on the short of root we that the left make to foot we that the left make to show the short of t

# THE CAMERA FAN

# Homemade Photo Match Books

HOWMAPP match books with favorite snapshots reproduced on the covers are now possible for any amateur who has access to a darkroom. An eastern manu facturer has placed on the market sensitized cardboard books which can be pur chased in quantities of fitty or more By contact printing the picture is recorded on the covers of the book. After the photograph is fixed and dried the book is folded and the matches inserted



Any negative may be printed on these match cove s

# Water Runs Film-Tank Agitator

Watth does the work of rocking a developing tank to agitate the chemicals and insure even development when a new teeler-lotter is placed under the stream from a kitchen faucet. The tank rests on one end of the device while water flows into a troughlike compartment at the other. When the trough fills the weight tips it down the water rushes out and the empiricular trough rase and is filled again. The agitator made of acid resistant metal accommodates all sures of roll film tanks.

# Enlarger Lamp Also Serves As Safelight

COMBINING duties of safelight and enlarger lamp a tinted bulb used in a re cently marketed en larger is in direct con tact with the air thus speeding up the dis sipation of beat and eliminating any pos sible damage to the film due to overheated metal in the enlarger bousing The exposed red upper surface of the bulb gives off a light which according to the manufacturer will not fog even the fastest enlarging papers

# Graduated Disk Fades Movies

A ROTATING disk gradu ated from transparency to opaqueness enables the home movie maker to pro duce fade uns and fade outs Simply by turning the disk he decreases or increases the light reaching the film



# JOHN H. WOOD

After the title is shot upside down to try peg is pulled away and the real rolls down the slop ng track. The film is turned dround when it is spliced in place so that the title appears to roll into view and then stop into view and then stop.



Action
Titles
PEP UP YOUR MOVIES



A photograph or enlargement of the first frame of a scene makes an excellent title background

ITLES containing or implying action do much to improve home movies, and making them can be just as much fun as shooting regular access. You can easily devise many ingenous titles your audience will be certain to expreciate

Taking a picture of a title upside down, then turning the piece of film eround and aplicing it so the action is reversed is an old trick, but one for which new variations are constantly being contrived by 16 mm move makers Charles H Taylor, of Chicago, suggests two such variations

In the first, titles roll into the picture on move-film reels To perform this stunt, support a yardstock across the back of two chars placed before a plain wall and of the stick. Let the edges of the cards extend above the surface of the stick both %" so as to form a shallow trough for the reels The letters, which may be paper, metal, or plastic, are fastened to the reels when the comment, was, or even cheungs and the comment was or even cheungs.

Place the reel or reels, as the case may be, so that the desured word or phrase is spelled upsafe down Elevate one end of the yardstock sightly and place a tooth-pack or pm tied to a thread in front of the reel Shoot the title long enough to record the word, then pull away the toothpick and the reel will oil out of the seene When the film has been processed, splice in the title bankwards

Mr Taylor's second trick produces the effect of a revolving reel unwinding film that moves across the Screen to spell out the title Support a large piece of cardboard across a doorway or between chairs as shown Starting with the first letter of the

title push long pins through from the back so they go through the track perforations and hold the film in place The title must of course be upside down

Wrap several layers of ad bessev tape around a pencil so the reel fits on it tightly and can be turned from the hack Arrange the lighting to cast shadows and thus give thickness to the letters. Number the puns on the back of the cardboard so your assistant knows in what order to pull them Shoot the title long enough to be read then start removing the puss and wanding the film onto the

Photographs magazne illus trations and even perces of a trations. And even perces of the backgrounds for titles. Some times an exceptional effect can be obtained by using an enlarge ment of the first frame of the secent The audience then seem? The audience then seem? The audience then seem of the first frame of the first frame of the secent The audience then seem? The audience then seem? The audience then seem to life when the words durant beautiful to the seem? The first fir

must be done very carefully if they are to look realistic

A double exposure title can be obtained by printing (or typewriting) the wording on the back of a photograph made on single weight naper. Himilate the title from the



With this set up the picture is photographed then of the prifed on gloss is swung in to position. The words will be distorted until the glass is vertical. Right oction con be impried by a clever arrangement of the letters. Here are three livitations.







LAKE PLACID

At left as the film is wound on the reel pins holding the letters in place on the eardboald are pulled from the rear



from and clare the cancers then gradually bound a bridge light by in back of the fiber bound a bridge light by the bound of the bound of the bound of the bound of the out of the bound of the bound of "5watt buth in back of the peture should be sufficient. You can cut down the displying opening by canning photofoods. If you want to not an enlargement of the first frame of be printed beckwards.

The action in the scene to follow a title can often be implied by a clever arrangement of the letters. Several examples are shown.

If you letter the title on glass, actual scenes may be used for the backgrounds. First focus on the title then gradually bring the background into focus. Remore the glass and continue the scene. Another idea is to start photographing a p cture then swing a glass with the title on it up into position over the p cture.

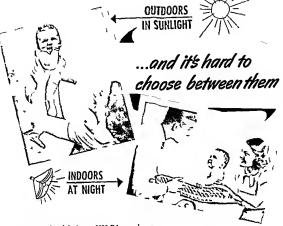
The stop-action reclamque has many applications. With this method a single frame is exposed (the camera is set at half speed and the button tapped quickly) then a slight change as made in the scene a second frame exposed, another sight change made and so on. Toys can be made to move about, and people appear of damppear mysterneum vall result. One move amateur made a very samusing time on amateur made a very samusing time on amateur the title were written on a blackboard, and toys "pranoed about in frect of each title.

### FERROTYPE HINTS

### [ PHOTOGRAPHY ]

Stale hypo baths containing exhausted hardening solution, cause much of the annovance arising from prints stucking to the ferrotype plates. Do not u.e beat to hasten divung of prints on black enameled plates. A small piece of beeswax or parafila, dissolived in a few ounces of gasoline is a cheap but good polishing solution. Apply with a small cloth, let dry to a matter surface their polish with a clean, soft cloth. Wrinkled prints caused by the wet prints pushing ahead of the rollier may be are ded by placing a heavy blotting paper over the prints and holding it firmly while rolling. If short of ferrotype plates or time dry the extra prints face down on a towel after washing their rescal, and ferrotype them later at your convenience. If Prints are voaked for about five minutes in a ten percent solution of glycern it will give them a more plable feel and also reduce staking and curling.

POPU AR SC ENCE MONTHLY SHOP DATA F LE



Bucaust Kodak Super XX Film is about four times as fase as ordinary film it makes even a beginner and a \$1 Baby Brownie a capable ream for pictures at night Getting excellent snapshots under Photofloods in doors after dark is a matter of using the right film. Be sure to load with Kodak Super XX Film. You can then from the very first count on snapshots at night that are just as good as those you ve been getting outdoors in the sun. Any cameri will do, just as long as it takes Kodak Super XX Film.

NIGHT SNAPSHOTS simple as ABC with

KODAK SUPER-XX



A Load your plesent camera with Kadok Super XX Film B Use a couple of inexpensive Maxda Pholaflood lamps in Kodok Handy Reflectors

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A few minutes with this helpful booklet end you re
headed for splend of night me anopshots Photos dia8 cms. cosy to understand directions. At your dealer's
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# YOU NEVER SEE HIM\_BUT SKILL FLIES WITH



THE ARMCHAIR above is h s cockput but B il Miller fires as many as 100 planes a day North south east and west from New Yorks LaGuardis Feld (air verv right) h s rad o coutrol room d rects the flying course of American's giant Bagsh ps

Fl er navigatot engineer traffic executive all a one-yes flight superintendent Bill Miller is a man with the extras-a man who gets the smoking extras too in Camels

For Camel's costler tobaccos and slower way of hurning give you more than midness on collection with a flavor that holds its appeal right through the last extra puff Camels also give you extra smoking per peack (see right).

GET THE "EXTRAS"-WITH SLOWER-BURNING

# CAMELS

HE CIGARE

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WILLIAM H. MILLER-Flight Supt., American Airlines



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mbulances and dectors' ers get there with Pres ne anti freeze inter protection that ban hes freeze up, boil away, aming fumes, rust and prosion One shot lasts l winter!





ilice Departments rely on Presione anti freeze do the armed forces of the Umted States Govern ent. Prestone anti freeze is made to an exclusive rinula GUARANTEED IN WRITING See your dealer and L e ea ! are regulered trade marks a



"YOU'RE SAFE AND YOU KNO!



# Old Bill says . . .

A RECENT TEST given six toolmakers to determine the exoct size of o commercial gange in ten-thousandth, suth all men using the some micrometer essuited in six different dimensions. Precision uithout shill si going to be one of industry's problems for some time.

Some means to filter the compound is imperotive to meet todoy's cylindircol frinding requirements It is the only way to aroud those lines which, although quite invisible to the naked eye, detract from the perfection of the finish.

If I were forced to decide on a certain construction of die set, among the various designs, I should select one with two leader pins ploced diagonally

Since apot welding is so commonly employed ond the necessage equipment is now so reosonoble in cost, why not use more eheop steels for shanks of end mills, counterbores, reamers, and the like?

It is modern practice to bevel the end of a plug gauge and grand o 14" width 0001" undee size This is o safety measure for both gouge and operator.

The proper metal cutting band saw in a good, modern machine will cut 1" thick tool steel, cold-rolled, and cast sron at the cote of 1", 134", and 334" per minute, respectively

Two bench-type, outomatic-feed threading mochines, side by side, prove profitable for identical thread production or usen to part involves two different pitches, or a left- and a right-hand thread. The operator need take but one step to load one machine while the other cuts

The latest technique in threading cough alloy steels with chasers, generally speaking, is a 10-deg. chamfer ongle, 10 percent more face grind than formerly used, together with the highest quality labricant, and the highest speed that will not generate heat



• Motorcycling opens up a whole new world of fun and excitement for you. And a 1841 Harley Devideon will make your dreams of thrills end adventure really come true? Glenous scoming power and rugged dependability to take you any place you want to go — anytime Yes, and plenty of good times with other rders on club runs and gypsy tours, at races, hillclined and other excitage events. See your Harley-Davidson dealer — get the thrilling story of motorcycling, the world's creative events, the world's creative.

est outdoor sport, and ask about his Easy Pay Plans.



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Address



# How to give a good rub down!

Fine abrasive powder mixed with water or oil can be used to rub down final coats of enamel lacquee or other material, to produce an even texture or special effect. This is only one of the many polishing operations you can do by mixing a little Carborundum Brand Silicon Carbide of Aloxite Brand Aluminum Oxide Powder with water or oil, and rubbing the work with it.

The illustration shows how to rub down a sprayed lacquer surface. Use a cloth or lelt pad and reduce the resource towards the end of the fin ishing operation. Then polish with a woolen cloth. This produces a fine sating gloss Many more helpful hints are given to the booklet offered below

Ask your hatdware dealer or nill supply house to show you the complete to control of cathorondom made of the complete states as the control of the control o and help you do CASSORUNDUM MATERIAL CALLERY

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CARBORUNDUM COMPANY

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am and Abotto are regis ered trade-marks of to mana active by The Lacksmootus (amount)



# Blueprints

# Solve Your Gift Problems

IFTS you make m your home workshop are always prized a great deal more than those bought at a store Whether you want to construct furniture, toys models photographic equipment, or notelties our plans will help you. The blueprints them selves make excellent gifts for men and boys who like to make things, and those marked with an asterisk (\*) in the list below are particularly well suited for this purpose Approximately seventy-five suggestions are given. Our complete blueprint list will be sent free upon receipt of a self addressed stamped envelope

### GIFTS FOR MEN

\*\*Colon Chief at Doc weeks 20 to 10 to 10

### GIFTS FOR WOMEN

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Combession, Harrise Rath, and Pool. Reel.

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Fad Table. And Table. 2014.

Brid. Table. And Table. 2014.

Brid. Table. And Table. 2014.

Brid. 2014.

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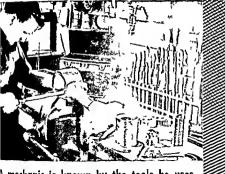
Sewing Cab nets Princing and Modern 31 ... (Continued on page 222)

Per em mit a Petras Schwer Monthly when well ag to ad it a s

POPULAR SCIENCE

25

zš



# A mechanic is known by the tools he uses WOLLD YOU be proud, or end arrassed to show a prospec

ne employer your private workshop or work hench — where you employer your build models "gadgets," practical devices keep yourchold equipment in repur where you add to your me hancal training toward greater extraings." Begin with your lies Are they cheap little known brands. Are they battered and your. Nicholeon and Black Diamond Files are the pride of skilled norm. Nicholeon and Black Diamond Files are the pride of skilled mechanics. Their superior performance far outweighs their small trac cost. A Nicholeon — largest file manufacturer in the world makes more than 3000 kinds, sizes and cuts of files, including namy special purpose files — such as Die makers, Aluminum Die ast Brack Foundry, Long Angle Lathe and Stamless Steel Good hardware and mill supply dealers earry a practical variety



THESE (

are now bong withe feat red by hardware dealers Left-SLIV TAPPR SAW FIFES framodory for handware sharpen are and many other uses. Above-114 VD FILE-stress files in one Sagle to so one at le do hee-t on the other-Ir to both an is hand on the first y I a. R. under flat he grup handle P les Cell plane weappet I shall be supported by the control of the property of the

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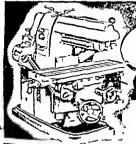
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# NEWS FO FRO



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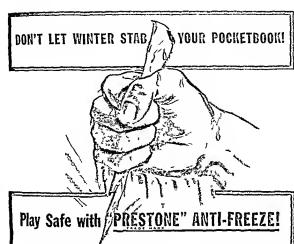
HE 1940 Home Workshop Index lists every item that has appeared in this department in all twelve issues of this year, including the present one It forms a readyreference key to approximately 900 closely packed pages of information on the use of tools and materials home repairs, new shop ideas, painting, radio sets automobiles, boat building, chemistry, microscopy, astronomy, and other service material

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The paraffin can be removed by gently warming the side of the jar or can under hot water and lifting out the disk of par affin with a nail or pointed stick -H. T



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#### How to Wipe Wet Negatives Without Scratching Them

ALTHOUGH cotton is often used for removing excess water from negatives awabbing them with tufts of cotton held in the fingers may cause scratches on the soft emulsion. A better method is to wind the cotton around a tapered dowel as shown. The wet cotton adhere to the stick.



#### Film Handle

MINIATURE 25 mm double frame film may be stored conveniently in the original cans with out danger of fin ger marking or scratching if it is first rolled around a cork and secured with a rubber band. The cork serves as a handle

### Unbreakable Stirring Rods

Rops for stirring and crushing pho tographic and other chemicals can be made from ordi nary five cent plas tic penholders Cut a short piece from the large end of each in order to re move the portion that is drilled out. These starring rods will not break and are not affected by the chemicals



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New 14" Delta Drill Press is six fools in one-Performs Efficiently: Wood and Metal Drilling, Sanding, Routing, Mortising and Grinding.

 Every workshop can use this new versatile Delta Drill Press It takes drills up to 1/1" in diameter, also takes all standard wood bits with 14" shanks, and can be used for borng holes up to 2" with standard multi-spur bits With proper Delta artachments this drill press becomes an effi tient mortising machine making square end mortises 1/2" to 14" wide of any length - also sander, grander and router Thousands of craftsmen say it is the most useful tool in their shop

# HAS MANY EXCLUSIVE FEATURES

Here is the only drill press that because of exclusive patents gives you the combination of BOTH Self Aligning Drive and Free Floating Spindle that guar antees accurate alignment Other features include 'Sealed for Life Ball Bearings that require no lu brigation for the life of the bearing, Graduated Ouill Adjustable Depth Pointer, Tilting Table with Index Pin and many others For the complete story speci fications and low prices see the latest Delta catalog

#### INSIDE SECRETS OF DELTA QUALITY "Dynamic Balancina" To insure true running of revolving parts, such as on

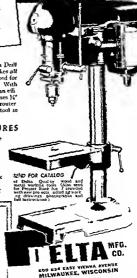
pulleys and wheels, Delta uses a special operation nown as Dynamic Balancing Many much ne tools have these parts. Stat cally

Balanced a method by which the part is mounted upon a shalt and then placed between two pormontal parallel kurfe edge supports so that the bears part of the pulley will naturally swing to the bottom The heavy part of the pulley is thus found and by means of a drill the excess metal is removed so that the puller is better balanced Stat c Balancing is not good enough for Delta

tools because it does not balance accurately enough Dynamic Balancing done with special del care electrical apparatus locates and corrects all heavy spots so that the revolving part is in perfect balance.
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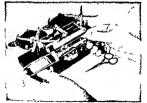
DHOTOGRAPHS of extraordinary depth of focus can be obtained by inserting a punbole iris between the front and rear elements of certain types of camera lenses. The sculptured figure ornament in the upper righthand comer of the accompanying night scene was about two feet from the camera yet it is as sharpby defined as the distant

huldings and lights in uptown Manhattan To prepare the camera the rear element of the lens was unscrewed a disk of black paper was cut out the same size and the center was pierced with a fine needle. The



New York night scene taken through a pinhole uses used with a Zeiss Tessar Anast gmat lens, 15 minutes on Super XX film

disk was dropped into the lens barrel and held flat by replacing the lens element. This in effect provided a new diaphragm stop equivalent to 1/531. The lens used was a Zeiss Tessar Anastigmat 1/45



#### TAPE PROTECTS FIGURES ON A DARKROOM SCALE

AFTEZ a darkroom scale has been use for a time the duvision marks and figures engraved on the beam are likely to become indistuct because of unavoidable corrosion caused by some of the chemicals used This can be prevented by covering the face of the beam with a strip of transparent error with the covering the face of the beam with a strip of transparent error with the movement of the aliding weight. If the tape becomes worn it may be replaced with a new piece—K. M.



shots! Flash them . . before they can get away . . . with Midget

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#### Looped Wire Prevents Loss of Camera Cable Release

MANY a photographer has suffered the loss of a cable release After one such experience sixty miles from the nearest camera store I determined it would never happen again I simply made a loop on the end of a were large enough to fit the body



of the cable re lease but too small to slide over the metal end The wire was then passed around the barrel of the lens and attached to it self by another loop The attach ment is shown in position at the left Any type of wire that is thin and strong may be used for this -F C

#### Stamps Copied Actual Size Without Use of Camera

STAMP collectors designing actual size reproductions of postage stamps will mad the
productions of postage stamps will not the
tan photography. Cut from glossy contact
printing paper a rectangle slightly larger
tana the stamp Place the face of the stamp
next to the glossy side of the paper and lock
in a printing frame Expose and develop in
the usual way You will have to find the
correct length of exposure by experiment.
Then repeat the process using the day paresult is aspector to a photograph in that it
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# He Invented the World's Deadliest Rille

(Continued from page 713

meeting was an offer to turn Garand loose in a room at the Bureaut of Standards and let him prepare a working model of his gun The salary was just half what he was receiving as a skilled machinist. But he tumped at the chance

For eighteen months Garand buried birnself in the room set aside for him. At the end of that time his gun was finished But so was the World War and the demand for machine guns was at a standstill However. the U S Army had become interested in developing a light, semiautomatic rifle a sort of compromise between a machine gun and a Springfield rifle Garand moved to the Armory in Massachusetts and tackled the fob

That was twenty-one years ago Ever since, the struggle to make this radically new weapon simple enough strong enough, and light enough, has continued three problems were in the back of Garand s mind night and day-when he was working, lying in bed, playing table tennis or badminton or borseshoes Often he came down to the Armory on week-ends and in the quiet of the great brick buildings wrestled with the toughest riddle of all, cutting weight to a minimum

There were many times when Garand was positive the weight requirement set by the Army could never be reached Eventually, hy saving an ounce here and an ounce there without ascrificing strength, he attained the goal Most of the weight elimination was accomplished by reducing the number of parts For example, one spring in the hammer mechanism now does the work that originally required five springs That mechanical short cut, alone clipped a whole bound from the weight of the gun Gas pressure produced by the discharge of the cartridge automatically ejects the aheil and cocks the gun, so all the operator has to do is pull the trigger In other words, Garand has put the 'kick' to work and by so doing has given American soldiers the best high-speed firearm on earth,

Along the road to this goal model after model was designed and worked out with infinite care only to be rejected after grueling tests Nearly a dozen kinds of gun ateel were tried, and the rear sight alone was redesigned fifty times The present Garand gun combines the best features of haif a dozen discarded designs All during these years other inventors were bringing forth ideas in (Continued on page 236)





A MODERN DOLL HOUSE -created ly a pationally known designer. A marrelous gift for the ally anown designer a marretous gitt for the young lady of telay. Exceptionally easy to findd strong and sturdy with Mass nite Tem-pered Presidenced. It makes a permanent gift that can be passed down through generations because Tempered Presilwood does not deterorate . . . will not warn, thin, and t or erack when used according to instructions.

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## He Invented the World's Deadliest Rifle

(Continued from page 235)

competition with the rifle Garand was making. His weapon won out over approximateby fifty different models which were suggested or submitted to Army experts.

In those last bectic days when the Arm ory was rushing through a bath of the new guns for large scale tests the workmen labored in two shirts night and day Gar and worked both shirts sleeping when he ordrande experts could devise. The gun was fired almost continuously far beyond the hunts of ordnancy use It was soaked in water and thrown in mud It was even placed no a sand hast machine for hours to see if any of the quarter grains would prize to true tests with styne colors.

Garand has turned down tempting offers from a commercial company and a foreign government in order to give the United States exclusive rights to manufacture his rifle For the price of one destroyer the whole U S Army can be equipped with

the superguns.

This then is the atory of the man be had the Garand rife—the story of a former motor cycle race crack abo, boy unenter and toolmaker who without benefit of a formal education or an engineering degree made frearms history. His two decades of concentrated application have produced a wespon which promises to be of outstanding importance in American defense.

#### "Miracle Measure" Gauges Thickness of Rust

Thickness of rust or weathering on sheets of iron can be measured to less than a hun dred thousandth of an inch hy a method developed recently by the Bell Telephone Laboratories in New York City A short aron rod with two coils of wire on it is pressed end on against each side of the coated iron sheet Both rods are magnetized by passing an alternating electric current through one of the coals on each rod. This induces a current in the other two coils The coating which is nonmagnetic reduces the induced voltage on its side of the sheet by an amount that depends on the thick ness of the coating The method can also be used to measure the thickness of coatings of paint paper or other nonmagnetic ma terials It is done without disturbing the coating

# Gus Gets Ready for Winter

(Continued from page 150)

to get a trunk tag and write on it and then the it on your filler cap so that gas station attendants wont add unneeded water It you do any long-distance driving during the winter, you should have your radiator level checked about once a month"

'I know those \$2 65-a-gallon antifreezes are good, Ez said But how about the cheaper ones? A feiler was tellin me the other day that he only pays a buck a gallon, an' that the stuff does the work

"Antifreeze are like most other things Gus replied The hase of most of the dollar-a-gallon mixtures is high-test methanol -wood alcohol-with something in it to prevent rust and corrosion. But methanol exportates—which means that you have to keep watching your mixture, and keep addung to it."

'How about plain alcohol?" Ez wanted to know 'We always used to use it, and

it did the trick,'

"It will keep water from freezing, all right," Ou said 'But engines run hotter now than they did only a few years ago, so plann alcohol is likely to hol away The only advantage it has over the suttirenze mixtures is that its first cost is lower-mixtures when the first first first cost is lower-mixtures for the winter that in the end it costs you as much as the made up mixtures, and you have a lot more hother with it."

Joe Clark's voice came from the office 'Hey, Gus Send Harry over to the golf club with the wrecker And Mrs. Miller says—darn that telephone"

Gus grinned "Time to go to work!" he

Said

Ez looked at his watch 'Holy cats" he
yelled "An' me with my mail not made up!"

#### "Roarless Road" of Asphalt Spares Motorists' Nerves

ROARING of thres on asphalt roads is said to be elliminated by a new kind of surfacing being tried out in Maszachusetts On a seven-mile stretch between Petersham and Barre, "pea stone "was used instead of the type of stone usually employed for surfacing Inspectors say that the new surface is equal to the old in quality and apped, while sparing motorists the nerve racking roar usually produced by three on asphalt roads iff the test provaccessful, the new construction plan will be widely used in future road building, it is predicted,







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## Alert Little Red Squirrel Guards Trinket Box

ATURE lovers will appreciate this trinket box upon which sits an alert red squirrel Suitable basswood boxes can be purchased at handicraft supply house and they should be stained light oak to contrast with the red mahogany stain used on the squirrel.

Jig saw the three sections of the squirrel to shape using plywood glued up from three thicknesses of ½" gumwood Join these parts with casein glue and drive small wire nails through the sections to

prevent shpping in the press
during overnight drying
during overnight drying
the nails are removed,
fill the holes with crack
filler Complete this
shaping, preferably
with rotary wood files
and dental hurrs held in
a chuck Make the eyes
of black glass headed
(Frey)

pins. When staining, leave the throat and stomach, as well as a narrow band around the eyes in the natural wood. Use black his for marking the mouth, nostrils whiskers and side stripes between the fore and hind legs. If the box is to be used for jewelry, hie the inside with felt or

plush.-EDWARDB FOX.



# Small Ship-Model Portholes

ON VERY small ship models, common pins can be used to represent portholes. They are cut short and driven in up to the heads. This is easier than painting them on.

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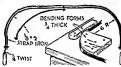


#### Metal Frame Lifts Bed Covers Off Invalid's Feet

ANYONE confined to hed for a long period can be made more comfortable by providing a frame to hold the bed covers up off the feet. The materials required are three pieces of % by 2,\* strap iron one 43 long an other 37\* and the third 14\* The joints are fastened with 8.32 machine screws.

To enable the frame to be folded flat for storage one end of the curved center brane is held with a short screw that projects about 3/16° as shown. When this projection is snapped into the hole at the center of the bottom piece the whole assembly becomes ried.

The frame is finished with a coat of aluminum paint followed by two coats of white enamel—R. E. MATHIAS



Three places of strop i on constitute the flome Wood scrops no led to the bench a dithe bending

#### Lacquer Marbleizes Wall Paper

FOR about three feet up from the floor the a de walls of our kitchen were somewhat uneven and rough. I put on a plastic effect wall paper and then brushed on linoleum lacquer which gives an attractive marbied appearance and protects the surface from water and grease. When first applied the lacquer appeared to have ruined the paper but if dried beautifully. Before trying this stunt, bowever; it would he well to test the lacquer on a sample of the paper as papers way a good deal—R. J. MCUTCHEN.



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SEE PAGES 218-225





#### Insulation Stripped Off Wire with a Claw Hammer

As ordinary claw hammer, used as shown with a combined pulling and twisting movement, makes an effective insulation re mover The wire should be held firmly in a asse or looped around a nail or piece of securely anchored wood.



## Cup Washers for Model Work Made from Upholstery Tacks

IF You are ever in need of small cup washers for model work or cabinetmaking, you can make them by driving brass-headed upheistery tacks into a

board and filing off the tops A very lit He filing will release the head from the nail, leaving a washer



# Cutter Fits on Paper-Tape Roll

CUT from a tin can, this simple device will Feep a roll of adhesive paper tape from unrolling and also serve as a cutter. It is held in place with a



rubber band and two short pieces of match sticks sure to press the burr or jagged edges of the two holes in the tin with a pair of phers so the edges will not cut through the rubber hand.-FRANK SHORE.

HOW MUCH



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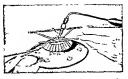
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## Old Bevel Gear Spaces Rods While They Are Welded

Wines, rods or small tubes can be sup ported in practically any angular relation to each other while being brazed or welded together if an old bevel gear, screwed from underneath to a metal base, is used The gear may have to be annealed before the screw holes are drilled

# Router Bits from Drill Points

Here is another way to heat the budget in enlarger the field of useful ness of your drill press The larger sizes of automatic drill points can be turned into very useful router bits by the method shown Au tomatic drill points are made to cut in both directions, and

DRILL

there is a tendency to burn the wood unless the trailing edges are ground off as indicated.-XURY R. SETTLE.

# **Bolt Aids in Starting Torch**

WHEN starting his blowtorch, one tinsmith inserts a large roundhead bolt into the burner cylinder as shown in order to deflect the atream of raw gasoline down into the generating pan until it is filled.



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to project as far as they will go They are then glued in this position

The center section or spacer 18 & CIFcular piece, cut slightly larger than the two largest pieces of the front and back From this section cut a hole 414" wide and 5" deep, in which a copper water container







fits Sand all parts to smoothness then glue together Finish by staining filling and varnishing in the usual way Bend and solder a copper water holder to fit snugly into the recess as shown on the preceding page—B B BRONSOV.

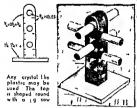
# License-Badge Pin Knurled to Prevent Slipping

To GUARD against losing a hunters here badge knurl the pin with a pair of phers This rough ens the pin so that it stays in place even if unclasped



## Table Cigarette Dispensers Made of Crystal Plastic

North egarette dispensers, from which your guests may help themselves at the table may he readily made from any crys tal like east resin plastic. The upright is a equare rod of clear plastic of the desired color. Shape it round at the top with a jig saw, and dril sit. \*§" holes in rows of three at right angles to each other as shown After being poished the upright should be cemented to a base of 'i," thick white plastic. This is another popular design perpared by the Metropolitan Junior Achievement. New York—K. M. S.



### Uses for Discarded Machine Beds

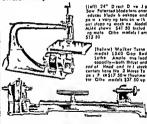
In Most machine shops it pays to save a few discarded machine beds for possible use in assembling the special shopmade equipment required from time to time in order to handle unusual jobs economically—H C

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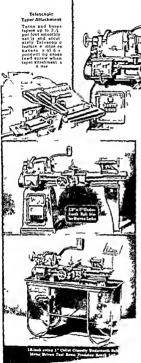
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